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AVIATION

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Louis F. Stoll, Vice-President

S. Paul Johnston, Editor

Leslie E. Neville, *Managing Editor* — Paul Wooton, *Washington*

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The Birdmen's Perch

We're suckers for compliments—you can't lay it on too thick. But please, when you send us fan mail, won't you enclose gossip and yarns whenever you can? The more stories we get, the more interesting the "Perch" will be. How about some squibs?

MAJOR AL WILLIAMS, *Manager, Aviation Department*
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

NOT A YARN AFTER ALL

That yarn in the January "Perch" about the aviator who was thrown from his plane and the passenger who brought the ship down safely turns out to be true. We have a letter from the passenger.

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Mr. Curtice, then knowing nothing about the operation of an airplane, was riding contentedly along enjoying the stunting when suddenly he noticed, not far below the plane, a man floating down with a parachute.

He turned hastily to call his friend's attention to the jumper and discovered that the plane was minus its pilot. The man with the parachute was none other than his friend, tossed out in some acrobatic maneuver.

Mr. Curtice, after a hectic period of experimenting with the controls, managed to bring the plane safely to earth.

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From August, 1934, to the end of December, 1935, planes of the Pennsylvania Air Lines flew approximately 1,250,000 miles on Gulf Aviation Gasoline, more than five times the distance from the earth to the moon. A good distance, a good airline, a good gas—say we.

ONE ABOUT THE EDITOR

"Major Al Williams—Dear Percher:

The last time I saw you in action you were testing a new Pursuit ship. Everything was going along fine until you tried to sit down. You overshot your field and seemed to be getting nowhere fast.

"The fun began when your new winged comet caught fire. How well I remember the sigh of relief that went up on the field when you finally got down.

"You probably don't remember who was the first bearer of a fire extinguisher to reach your side. Well, I was it.

"My old Pitcairn Mail-wing is as old as Methuselah's great-grandmother, but one of these days I'll put a pint of Gulf gas and oil in her tummy and pop up to see you in Pittsburgh."

—C. A. C.

THIS MONTH'S WHOPPER

"They call me Dizzy Van, the Motorcycle Man. Four years ago I was a famous daredevil. Now I don't have enough nerve to walk across the street.

"My act was a thriller. I started my motorcycle circling around the bottom of a 40-foot wooden bowl. As I gained speed I would spiral to the top, then cut down the motor and return.

"One night a friend got me to try Gulf Aviation Gas in my machine.

"As soon as I started I knew I'd done the wrong thing. I whirled to the top in half the usual time but when I tried to slow the darn thing down, it was no soap.

"The motorcycle circled so fast that I had hard work holding it in the bowl at all. My brakes shot up in smoke. And there was I, whirling around like a fly on a phonograph record. I kept going for days.

"Finally the gas gave out and I sank to the bottom of the arena—more a merry-go-round than a man.

"Since that time I am only happy when I spend my days in a revolving door and my nights sleeping in a barrel." —V. H.

YOUNG CARTOONIST

The cartoon in the lower left hand corner of the page was sent in to us by Paul E. Tuttle, East Orange, N. J. The artist writes: "I am 23. Attended the Museum School of Fine Arts in Boston. Aspired to become a cartoonist, and don't mind telling you that your letter of appreciation was a Godsend."

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...Gulf Refining Company...makers of

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China Spreads Her Wings

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For centuries China has depended upon its few great rivers for contact with the outer world and its maze of canals for internal communication. And it was only with the sudden awakening to national consciousness by the Revolution of 1911 that China began to avail itself of the Western automobile and the locomotive.

With due credit to the signal progress achieved in surface transportation in the past quarter of the century, there is in China today, however, a bare 7,000 miles of railroad tracks and about 40,000 miles of motor roads. Compare these totals with the 250,000 miles of railroad tracks and 3,000,000 miles of motor roads in the United States.

Obviously, the future in the commercial development of this vast potential market, in a modern world keenly attuned to the development of new outlets for its over-producing industries, lies in the expansion of China's commercial airlines.

Unfortunately, recurrent political disturbances have discouraged the progress of commercial aviation. It was not until 1929—only seven years ago—that the first regular commercial airline was established by the Aviation Exploration Inc. (a Curtiss-Wright subsidiary) under a franchise signed and issued by Sun Fo, then Minister of Railroads. This fran-

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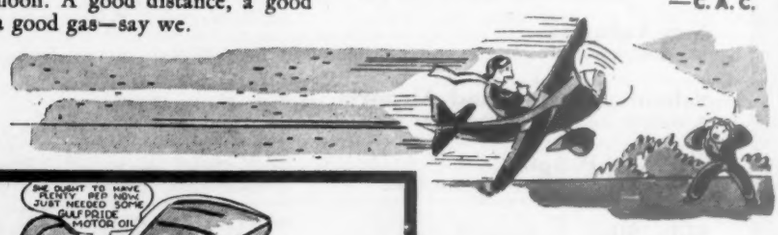

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chise called for the exclusive carrying of air mails and passengers from Shanghai to Hankow, thence from Hankow to Peiping, and Hankow to Canton. Operating Pratt & Whitney "Hornet"-powered six-place Loening amphibions, service was at first offered only from Shanghai to Nanking—a distance of about 200 miles.

Five Years of CNAC Progress

Year	Kilometers Flown	Passenger Km. Flown	Passengers Carried	Kilos of Mail Carried
1929.....	93,167	106,875	354	3,932
1930.....	531,196	1,027,902	2,654	17,893
1931.....	716,201	976,831	2,296	34,428
1932.....	693,842	1,247,265	3,153	50,851
1933.....	1,024,963	1,451,384	3,138	49,246
1934.....	1,435,460	2,553,283	5,224	58,052
1935*.....	1,594,088	4,389,555	7,932	55,310

*Ten months.

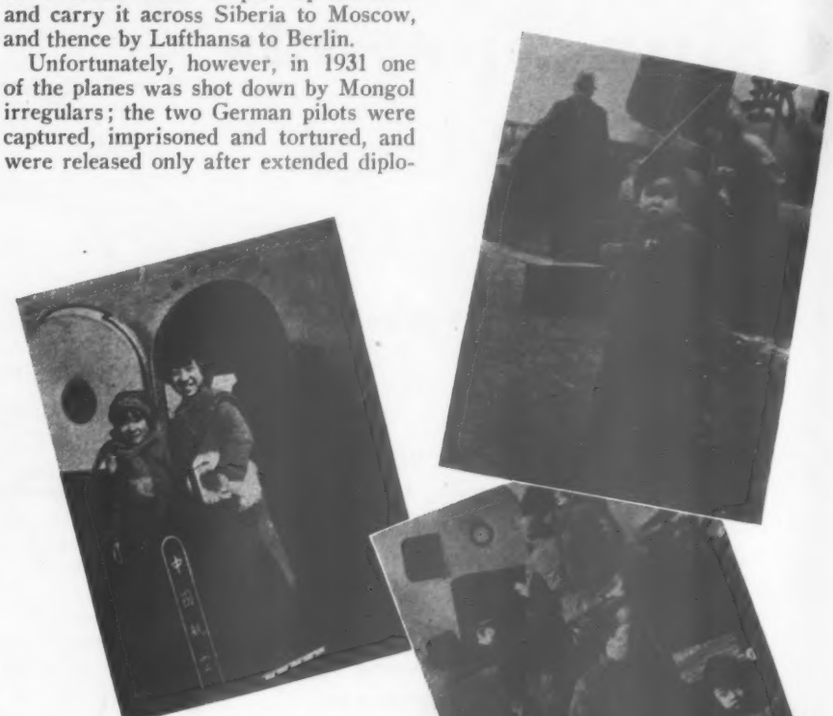
With the reorganization of this company into the China National Aviation Corporation (CNAC) in July, 1930—a $10,000,000 company of which 55 per cent was subscribed by the Chinese Government and 45 per cent by Curtiss-Wright (this minority was recently purchased by Pan American Airways)—plans were made for the extension of air services to tap the most important productive and commercial centers of the country.

By 1934 CNAC had extended its lines nearly 2,000 miles up the Yangtsze River to Chengtu, the capital of Szechwan (a province of untold commercial wealth, within whose borders alone reside some sixty million people, half the population of the United States), south a thousand miles or more to Canton (capital for South China), and north to Peiping (beautiful seat of China's one-time imperial glory).

In the meantime, Eurasia Aviation Corporation — a $3,000,000 company owned two-thirds by the Chinese Government and one-third by Lufthansa—had attempted to establish an airline from Shanghai to Berlin. Flying single-motored all-metal Junkers, its original route extended from Shanghai northward through Peiping and across Mongolia to Manchouli on the Siberian border, where the Russians were to pick up the mail and carry it across Siberia to Moscow, and thence by Lufthansa to Berlin.

Unfortunately, however, in 1931 one of the planes was shot down by Mongol irregulars; the two German pilots were captured, imprisoned and tortured, and were released only after extended diplomatic negotiations. One of the pilots subsequently suffered the amputation of a leg as a result of lack of proper medical care for a wound received in the knee when the plane was fired upon.

Disgusted, Eurasia abandoned this line and proceeded to route its planes to the northwest, touching at Nanking, Sian, Lanchow and on up to Urumchi (capital of Sinkiang Province) with the terminus as Tchukuchak on the Siberian border. Regular service was begun in December 1932 from Shanghai to Lanchow. (I flew with them on one of these pioneering trips.) Though service to the northwest from Lanchow is scheduled and advertised, owing to ever-changing political conditions in Sinkiang, this leg is not operating regularly. [The author will deal more completely with the activities of Eurasia Aviation Corporation in a following article.—Ed.]



The curious gather about the metal bird at Chengtu. But all of the above are not sightseers. The little fellow in the top picture traveled alone 1,000 miles by air to visit his uncle, the gentleman in the left background.

CNAC Douglases carry an American pilot, Chinese co-pilot and radio operator. The steward-"ess" is also Chinese—and very proud of his uniform!

But many changes have taken place in the last two years. In 1934 CNAC was operating the old-reliable 95-miles-an-hour "puddle-hopper" Loenings. In my article which appeared in the May 1934 issue of AVIATION I wrote of the

It's a long way from Santa Monica to the fringes of Tibet. A CNAC Douglas at Chengtu.

600-mile journey from Shanghai to Hankow (a steamer trip of three to four days) as being made in "only seven hours." A few months ago I traveled this same leg in a little more than three hours! And the trip from Shanghai to Chengtu, which CNAC covered in two long days two years ago, I traveled a few months ago in seven hours. (By steamer, the only alternative mode of travel, it takes from *two and one half to three weeks.*

The Chinese have so taken to air mail and air travel that CNAC in barely six years of life—though entirely unsubsidized—is not only out of the red but is actually earning money. Which is a whole lot more than can be said about many another major airline in all the world! The French airlines, for example, are subsidized, some of them, as much as 77.5 per cent of their total income. A reliable estimate asserts that for each ton of air express (or "air freight" as it is called abroad) on the Marseilles-Algiers line alone costs the French taxpayers 568,000 francs.

It might be of interest here to note in the table the extraordinary progress made by CNAC in the short period of its existence.

And so, as a result of this encouraging air-mindedness of the Chinese, CNAC is constantly improving its service. Today it is operating Douglas DC2's, identical equipment used by TWA, American Airlines and Pan American—the most modern air services not only in America but in the world. And that isn't all. CNAC has on order a number of Sikorsky S-43's which will be placed in service on the Yangtsze and coastal routes as soon as they are received.

Schedules are constantly being shortened with more and more frequent service being offered. The table of time for mail and passenger transportation by fastest ordinary methods as compared to the time taken by air transportation will account for the growing popularity of air services.

From conversations with H. M. Bixby and William Bond, officials of the CNAC, and with Capt. E. M. Allison, veteran Chief Pilot (rated as one of the finest of airmen in the world for such extraordinary flying conditions which obtain in China), I learned of plans by CNAC to extend their Yangtsze line from Chengtu a thousand miles or more westward across the breath-taking heights and eternal snows of mysterious Tibet to Lhasa—its sacred, forbidden capital. The first flight for this extension will be undertaken some time this summer, with Capt. Allison at the controls. When placed into regular operation this service will cover a distance in one day which ordinarily takes several months of rigorous horse- and yak-back travel over the most dangerous trails.

CNAC has also branched from its Yangtsze service from Chungking via Kweiyang to Yunnan, capital of the politically important province of Yunnan, the terminus of the French-built and operated railroad from Yunnan to Hanoi and Haiphong in French Indo-China. And only last February service has been inaugurated from Canton to Hanoi.

Though CNAC is administered by a directorate of three Chinese and two Americans, operations are entirely in the hands of American technicians and pilots. Each plane carries, in addition to the American pilot, a Chinese co-pilot and a radio operator (both American-schooled). The Douglas DC2's carry also a uniformed steward-"ess." The steward-"ess" is usually an English-speaking Chinese boy who serves refreshments

Air Transportation Compared with Other Methods

Ports of Call	Fast Ordinary Methods (Train, Steamer, Animals)	Present Regular Air Service (Douglas Dolphins)	Present Express Air Service (Douglas DC2's)
Shanghai to			
Nanking.....	8 hr.	1 hr. 20 min.	1 hr.
Kiukiang.....	3 days	3 hr. 22 min.	2 hr. 35 min.
Hankow.....	4 days	4 hr 45 min.	3 hr. 30 min.
Hankow to			
Shasi.....	2 days	1 h... 30 min.	.....
Ichang.....	3 days	2 hr. 30 min.	1 hr. 5 min.
Wanhsien.....	7 days	4 hr. 55 min.	.....
Chungking.....	9 days	7 hr.	3 hr. 10 min.
Chungking to			
Chengtu.....	2 to 5 days	2 hr.	1 hr. 5 min.
Kweiyang.....	12 days	1 hr. 45 min.	.....
Yunnan.....	24 days	4 hr. 15 min.	.....
Shanghai to			
Haichow.....	36 hr.	3 hr.	.....
Tsingtao.....	36 hr.	4 hr. 35 min.	3 hr. 10 min.
Tientsin.....	38 hr.	8 hr.	5 hr. 15 min.
Peiping.....	43 hr.	9 hr.	6 hr.
Shanghai to			
Wenchow.....	1 day	1 hr. 55 min.	.....
Foochow.....	2 days	3 hr. 35 min.	.....
Amoy.....	3 days	5 hr. 5 min.	.....
Swatow.....	3½ days	6 hr. 25 min.	.....
Canton.....	3 to 5 days	8 hr. 30 min.	.....

and attends the passengers just as do our stewardesses upon our own airlines.

CNAC has had but one serious accident. Early in its life—Dec. 9, 1930, to be exact—a Loening taking off from the river at Lunghwa airdrome (near Shanghai) hit the mast of a crazily meandering river-junk and crashed, killing five and injuring two. In the nearly six years since, though flying under the most trying and hazardous of circumstances, CNAC has operated without a single serious mishap. And it has attained an extraordinary record for efficiency, with an exceptionally small number of uncompleted scheduled flights.

While the flying boats land in the river alongside the cities, the landplanes are obliged to use the military fields. This is at best unsatisfactory — the military being jealous and desirous of maintaining their privacy. There are always groups of soldiers in the fields who have strict orders to prevent the taking of any photographs. Through the courtesy of Mr. Pauen Y. Wong, business manager and treasurer of CNAC who gave me a special covering letter to show whenever a prodding, inquisitive bayonet hurried into action when my camera came into view, I was enabled to secure the photographs which are used to illustrate this article.

This letter, however, permitted me to take pictures only of the plane and its occupants. And since I was not permitted to take pictures from the air, I can give only limited descriptions of the airports and their equipment as I observed them.

CNAC's base and principal workshops are located at Lunghwa airdrome, a few miles up the Whangpoo River from the International Settlement of Shanghai. Here are located big, substantial hangars, well-equipped for almost any major type of repair work or overhaul. Well-trained foreign and Chinese mechanics are employed. The field is a generous one, fronting the Whangpoo River, with its other three sides free and unobstructed. It is planned soon to build a $5,000,000 airdrome on this site—one that will rank with the finest in the world.

The Nanking airport is the field used by the military planes. It has good hangars there; but they are for the exclusive use of the Air Force. The Government also maintains an elaborate repair shop here to service its military planes. Passenger planes come in low over the massive City Walls, built in the Ming Dynasty (1364-1644) and go into a long glide to the field lying almost in the shadow of Purple Mountain with its magnificent shrine to Sun Yat Sen (the George Washington of China) half way up its hillside.

Hankow, the "Chicago of China," also has a fine airport, with excellent hangars and shops; which, too, are reserved for the military planes. Ichang, gateway to the Famous Yangtzse Gorges, is about a thousand miles up the river from Shanghai. It is a small river port with the air field built on a sandy beach formed by a bend in the Yangtsze.

East or West, it takes gasoline—

Chungking, important commercial center for Szechwan, with a population of about 600,000, has its airport also built on a sandy stretch formed by a bend in the river. The field is long but narrow. It is bordered on one side by the river and on the other side by a towering cliff, atop which is built the city of Chungking. A military telphone wire is strung from the city on the cliff-top sagging down over the field and across the river to a group of barracks on the opposite shore cliff-top. The planes must necessarily glide in under this wire as they come in for a landing—a ticklish business.

Chengtu, the capital of Szechwan, lies about 200 miles to the northwestward, away from the Yangtsze. Here Chiang Kai-shek has recently built a fine airport with excellent hangars—also for the exclusive use of the military.

Be that as it may, the planes really don't need hangars nor major servicing facilities at the various ports of call since they rarely stay longer than overnight at any place other than at Shanghai.

There are eleven pilots in the CNAC —all Americans, with the exception of one, a German. In addition, there are two Chinese pilots who fly Stinsons on the Chungking-Chengtu section, where the air traffic is heaviest. These two Chinese, incidentally, are American-born and American-trained; and both had to learn how to speak Chinese upon their recent coming to China!

Having spent about four years in China, in which time I covered quite a deal of the country—mostly on foot or on horse—I am one who appreciates the value of air travel, especially in a country like China.* Recently, in about ten weeks I covered approximately 50,000 miles on a trip to the Far East and return. Catching a Douglas DC2 of the American Airlines out of New York last Christmas eve I was in Los Angeles the next evening. (I felt like Santa Claus all day Christmas with about 1,500 "r.p." —"reindeer power"—pulling my silver-winged chariot through the skies with the speed of the wind!)

At Los Angeles I transferred to one of the United Airlines' Boeings and flew up the coast, arriving at Vancouver just before sailing time for the CPR's "Empress of Canada." The day after I landed in Shanghai I boarded one of the CNAC's Douglas DC2's and that same night had dinner in Chengtu—nearly 2,000 miles westward from Shanghai. It had been barely three weeks since I had left New York, and about nine-tenths of that time was spent at sea. People in Chengtu could hardly believe my story. It would take them that much time for a tedious journey across the province, they said.

One of the most-remembered features of this trip was the flight over the famed Yangtsze Gorges beyond Ichang. A mighty, awe-inspiring sight; described by many as truly the Eighth Wonder of the World. Recently I had occasion to fly over the Grand Canyon on the TWA lines. The first time I had seen this magnificent handiwork of Nature's artistry from the air. Really, if my fellow-passengers had been Chinese instead of Americans I might well have imagined myself flying over the rugged grandeur of the Yangtsze Gorges.

**A detailed account of the author's travels in China and Tibet may be found in his "Through Forbidden Tibet—An Adventure into the Unknown," Longmans, Green and Company, New York.*

and what is being done about it —

A résumé of projects, some completed, some in active development, designed to eliminate one of air transport's major hazards, icing-up in the air

By S. Paul Johnston

WHEN, in the November (1934) issue of AVIATION, we discussed icing, the air transport people were just beginning to realize the nature of the problem and were beginning to reach out toward practical means of solution. Now, some eighteen months later, with two more winter seasons behind them, operators have moved well along toward the final answers to some of the more perplexing questions. Certain of them may be considered as solved, others are well in hand.

Surface de-icing belongs properly to the first category. The leading edge overshoe as developed by the B. F. Goodrich Company (in cooperation with the major airlines and the Air Corps) is substantially the same in form and in method of operation as was described a year and a half ago. Where, in late 1934, only a few experimental installations were in use, the winter flying season of 1935-36 saw a large majority of the airliners on the major routes so equipped.

But the job had cost many a headache. Once the general operating principle had been worked out, installation problems aplenty cropped up. These difficulties were surmounted, however, and ships sent out for service on the airways. But, further and more serious trouble arose almost at once. At high speeds the rubber overshoes refused to stay put. The cement which had been relied upon to hold the rubber elements to metal skinned wings showed an alarming tendency to loosen in flight.

Here was a new and unexpected problem for, obviously, as a safety factor, a loose de-icer is worse than no de-icer at all. Goodrich engineers got busy and settled the problem once and for all by developing a mechanical fastening device to keep the rubber shoes in place. They had to do some inventing in the process, for it is no easy matter, as every aircraft designer knows, to drive a rivet from outside a closed section. The leading edge of most metal wings offers little opportunity to get a backing-up tool inside. The result was the "Rivnut," essentially a hollow threaded rivet which may be installed and headed (or upset) while working entirely from outside the wing. How the Rivnuts are applied to make flight-proof attachment for de-icing overshoes can be seen in an accompanying sketch. Although developed primarily for this one purpose, they have many other applications and may be used wherever it is necessary to attach accessories or fixtures to sheet metal structures. Two special hand tools were developed to permit application of Rivnuts equally well in factory or in the field.

With the solution of the fastening problem, the whole matter of wing de-icing may be considered to be well in hand. Other refinements, such as improvements in plumbing, in control valves, and in the means of obtaining the required compressed air, are being added as time goes on, but the major difficulties have been overcome.

We recently had an opportunity to observe a test on a Douglas DC-2. It was sent out deliberately to look for an icing condition and found it in a big way. Ice over 2 in. thick formed completely over the nose, covering windshields so completely that the pilot had to break the glass out to effect a safe landing. The ice around the pitot supporting strut was 5 to 6 in. in diameter. But, except for a paper-thin film over a portion of the top surface of the wing well behind the leading edge, all areas behind the de-icers were entirely clean. On the wing tip, beyond the end of the de-icer, a 2 or 3-in. accumulation at the leading edge was noted. Few more convincing tests of the efficacy of the rubber de-icer have come within our observation.

A great deal of the credit for the successful solution of many air icing problems goes to TWA for its extensive high altitude work with the DC-1 under D. W. Tomlinson.

In passing, it may be mentioned that a system of surface de-icing has been developed abroad that is similar in principal to one of the propeller methods described below. Instead of pneumatic inflation of leading edge shoes, rubber

elements are applied in somewhat the same manner as the de-icers, but they are provided with many small tubes through which a de-icing fluid is forced, to seep out through minute perforations to keep the rubber surfaces continually wetted. This system has been studied but has found little favor here.

Keeping propellers clear

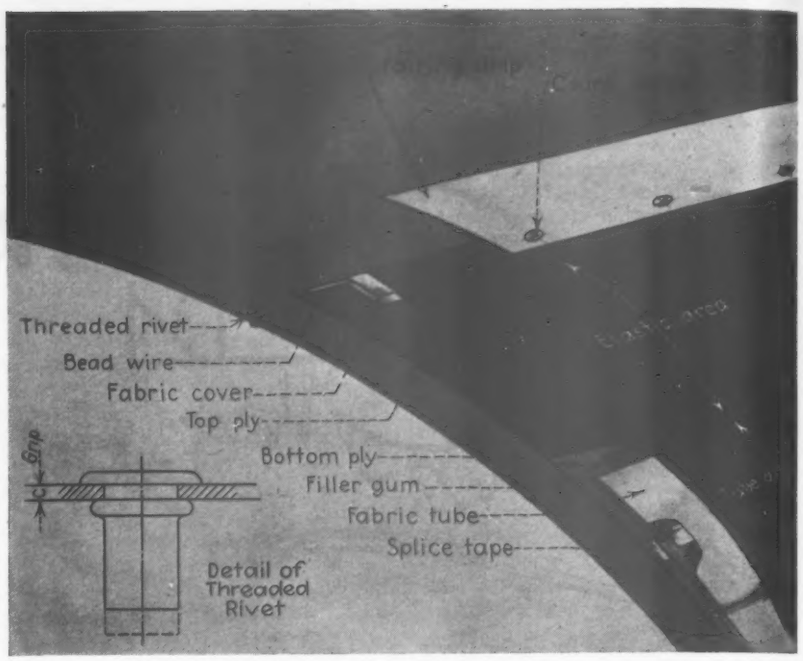
So much for wing de-icing. Coincidental with the wing research, and equally important, was the solution of the propeller icing problem. Obvious, of course, was the danger of letting ice accumulate at the hub and along the blades; less obvious was the means of preventing it. Between 1932 and 1935 considerable success was attained in the use of large spinners covered with sheet rubber and painted with a special de-icer oil which would last on an average of 2½ hours, or for the ordinary trip length. It was a nice problem to develop an oil that would not be too light to be thrown off by centrifugal force, and not be too sticky to tend to make the ice adhere. The obvious "out" was to use the light oil and to provide some means of feeding it continuously into the hub in such a fashion that it would be spread out over the propeller blades by centrifugal force.

After a long series of experiments in the refrigerated wind tunnel of the Goodrich Research Laboratory, a device now known as the Slinger Ring was developed. This project was developed with the active cooperation of the Bureau of Air Commerce and TWA.

Briefly, the slinger ring is a circular trough of inverted U-section bolted to the rear face of the propeller hub and fitted with short discharge tubes that open onto the base of each propeller blade on the thrust side. Liquid (oil, or anti-freeze solution) is fed into the open ring from a feed pipe clamped to the engine nose piece and connected to a suitable supply tank and control valve in the fuselage. Thus the liquid from the tank drips into the rotating ring and is distributed by centrifugal force outward along the propeller blades.

In conjunction with the rubber-covered spinner, which is necessary to break the continuity of ice across the propeller hub, there are two separate methods of de-icing propellers that have been tested, of which the second is now in use. The first involves the covering of a portion of the leading edge of each propeller blade with rubber sheeting (fastened down with cement) and feeding de-icing oil onto it continuously from the ring. The second involves continuous feeding of an anti-freeze solution (usually a mixture of fifteen parts glycerin to 85 parts alcohol) on the bare aluminum alloy blade. The mechanics of feeding the solution to the blade are the same in either case.

As far as the relative merits of the two systems are concerned, the rubber-covered, oil-treated blades have the single advantage that the blades will continue to de-ice as long as the rubber retains any oil at all. On the other hand, there is considerable labor involved in applying the rubber covering to the propeller blades, also the efficiency of the blades is probably impaired by the rubber sheeting. There is also considerable maintenance involved in servicing the rubber coverings and keeping them oiled even when on the ground, for rubber must not be allowed to dry out.



When it was found that cement could not be relied upon to hold leading edge De-icers on metal surfaces at high speeds, Goodrich devised this mechanical fastening device to do the job. Essential element in the system is the "Rivnut" (detailed at lower left).

For the anti-freeze solution on bare blades, the installation is very simple. There is no change in blade contours tending to aerodynamic inefficiency, ice is shed in very small particles, and there is instantaneous shedding of ice formations which have been allowed to accumulate before the system is turned on. The arrangement has the single disadvantage that de-icing stops immediately when the supply of fluid ceases.

Adding everything together, the conclusion has been reached that the proper system to apply is the anti-freeze solution on the bare blade. This is recommended by the Goodrich Company.

Referring again to the icing test that came under our personal observation a few months ago, it was noted that propeller hubs and blades were entirely free of ice accumulation while the fluid was turned on and that furthermore the fluid flying off the blades was picked up on the engine cowling and kept the leading edges of the cowling entirely free from ice.

Beyond the single test flight mentioned above, a long series of test reports is available from the work done by D. W. Tomlinson of TWA on the experimental DC-1, all of which testify to the effectiveness of the wing de-icers and the slinger ring.

Ice in carburetor

With wing and propeller de-icing now under control, attention has been centering recently on what is probably the most serious angle to the whole problem, the elimination of carburetor ice.

It has been only within the last two or three years that the significance of carburetor icing has been realized or that the mechanism of ice formation in carburetors understood. Such ice formation is not necessarily confined to winter operation but may be encountered with outside air temperature as high as 50 or 60 deg. F. above zero. What happens, briefly, is this. A certain percentage of the fuel entering the carburetor vaporizes as it leaves the carburetor jets. This vaporization drives heat away from the surrounding air and a temperature drop occurs which may (depending upon the fuel, the altitude, and on other variables) be as much as 50 or 60 deg. F. This means, of course, that any moisture in the induced air will freeze as it passes through the carburetor venturi and may adhere to the venturi walls or to the throttle butterfly. (For a complete study of the problem see "Ice Formation in Carburetors," by W. C. Clothier, *The Journal of the Royal Aeronautical Society*, No. 297, Vol. XXXIX, Sept., 1935.) If nothing is done about it, such ice for-

mation may materially reduce the air flow, choking off the air supply to the engine and immediately cutting down the power. The most serious aspect of the situation is that atmospheric conditions may change very suddenly and ice formation may occur without any warning whatever to the pilot before his engines begin to lose revolutions and power. Serious ice accumulation may occur very rapidly, in a matter of seconds, a condition that has undoubtedly caused a number of accidents in the past for which no other reason could be assignable.

The most apparent solution of the carburetor problem was to apply heat either to the incoming air or to the walls of the carburetor barrels or even in the throttles themselves. Walter A. Hamilton, superintendent of maintenance for TWA, presented a study of heat application to carburetors in his paper "Carburetor Icing in Airline Operation," read before the annual meeting of the Society of Automotive Engineers at Detroit in January, 1936.

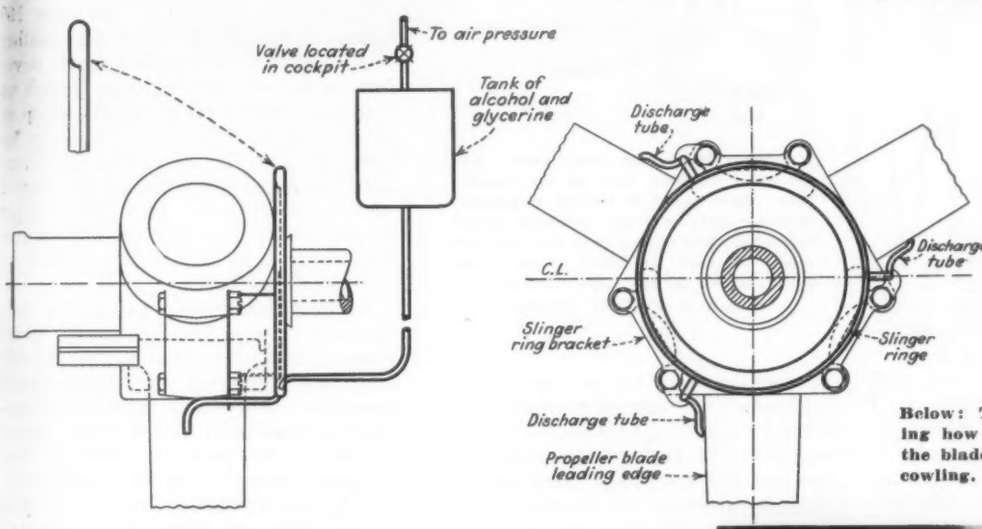
Heat is supplied to incoming carburetor air most commonly by means of intensifier tubes, as shown in one of the accompanying illustrations. In discussing this type of installation, Mr. Hamilton pointed out that great care is necessary in proportioning the control valve regulating the supply of hot and cold air, first so as not to reduce the "ram," or dynamic head of air on the carburetor scoop due to the forward motion of the airplane, and secondly to maintain correct values of pressure and vacuum throughout the whole range of control. The valve system must also be strong enough to stand up under carburetor backfire. Intensifier tubes must be of adequate capacity to supply heat, but must not be large enough to build up back pressure in the exhaust system. He points out also that it is very important that if the intensifier inlet openings extend forward through the intercylinder baffles, an auxilliary opening must be provided behind the engine (and preferably close to a cluster of exhaust manifolds) of sufficient size to insure adequate induction in the event the main inlet became clogged with ice or snow.

Although the application of heat to carburetor intake air in this fashion offers one way out of the difficulty, it has its drawbacks. The system is expensive both in first cost, maintenance and in weight. It demands constant attention by flight personnel and if not used properly, may easily result in reduced engine efficiency and even serious damage to the power plant. Injudicious use of the heating system coupled with faulty mixture control may easily result in destructive detonation.

Altogether, then, this solution, although in use today on many airplanes, is only a stop-gap and must be eliminated in favor of more efficient and less costly types of icing control.

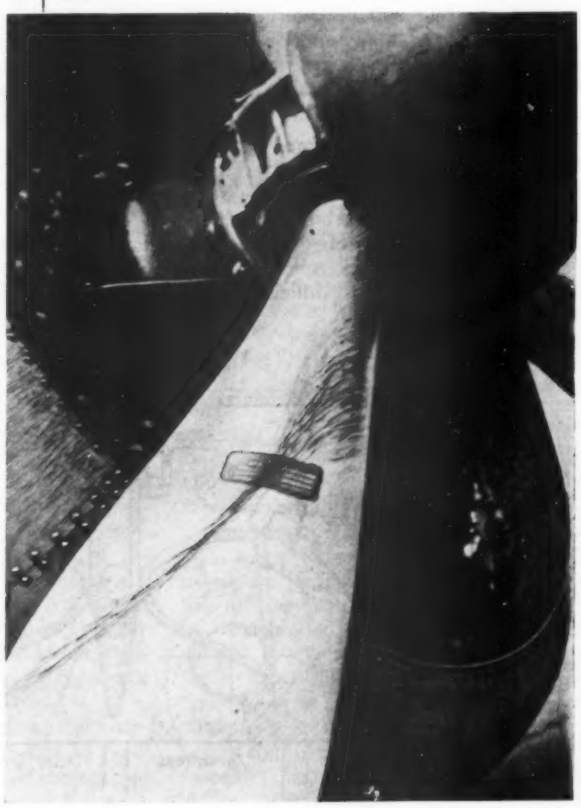
With this in mind the Development Section, Bureau of Air Commerce, has long since been working on a number of projects in cooperation with certain manufacturers. So far, three distinct lines of attack are being pursued, two involving extensive redesigning of carburetor principles and a third involving non-freezing fuel mixtures.

One of the two carburetor projects, a design by the Bendix Stromberg Carburetor Company, is now undergoing final testing at the Naval aircraft factory. This is a three-barreled, downdraft type fitted with selective automatic or manual mixture control. An outstanding feature is the provision for the injection of alcohol into the venturis just ahead of the main discharge nozzles. The flow of alcohol is regulated by a small float operated valve. Under normal conditions this valve remains closed and no alcohol flows, but when icing begins in the carburetor barrel the valve automatically opens and alcohol is introduced into the fuel mixture.



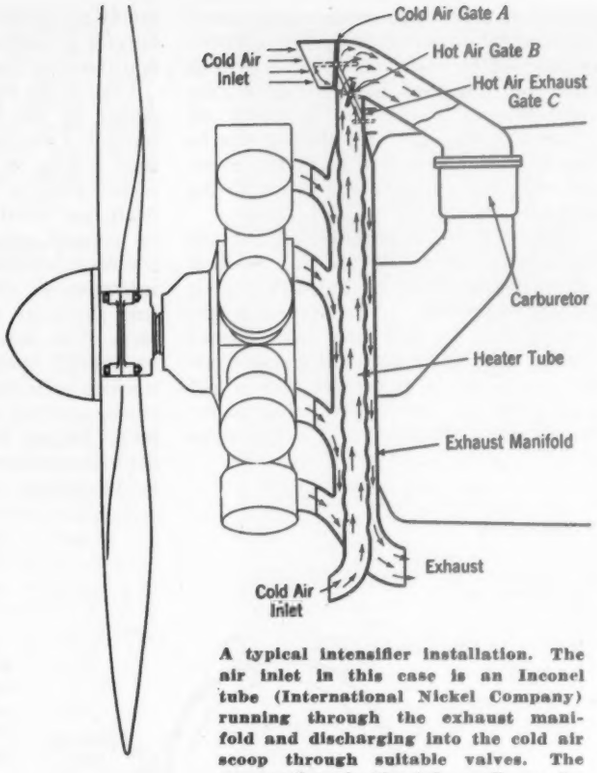
Left: Slinger Ring installation on a three-way propeller hub. The brackets are held in place under the regular hub bolts.

Below: The Slinger in action showing how the fluid flows out along the blades and sprays off onto the cowling. Note feed pipe, left center.



This is accomplished by controlling the float valve through a balanced diaphragm relay so arranged that when a small aperture in the carburetor barrel ices over, an unbalanced condition exists on the diaphragm which permits the valve to open and the alcohol to flow.

Not only is alcohol injection provided, but arrangements are made to heat both the barrels and the throttle disks by circulating some suitable heated fluid through them. It is for this reason principally that the carburetor has been made up in two parts bolted together, first the barrel casting with its integral jacket, and secondly the float chamber and fuel section, which of course should not be heated. Insulating washers between the castings reduce heat flow.



A typical intensifier installation. The air inlet in this case is an Inconel tube (International Nickel Company) running through the exhaust manifold and discharging into the cold air scoop through suitable valves. The corrugations in the tube wall are designed to aid heat transfer.

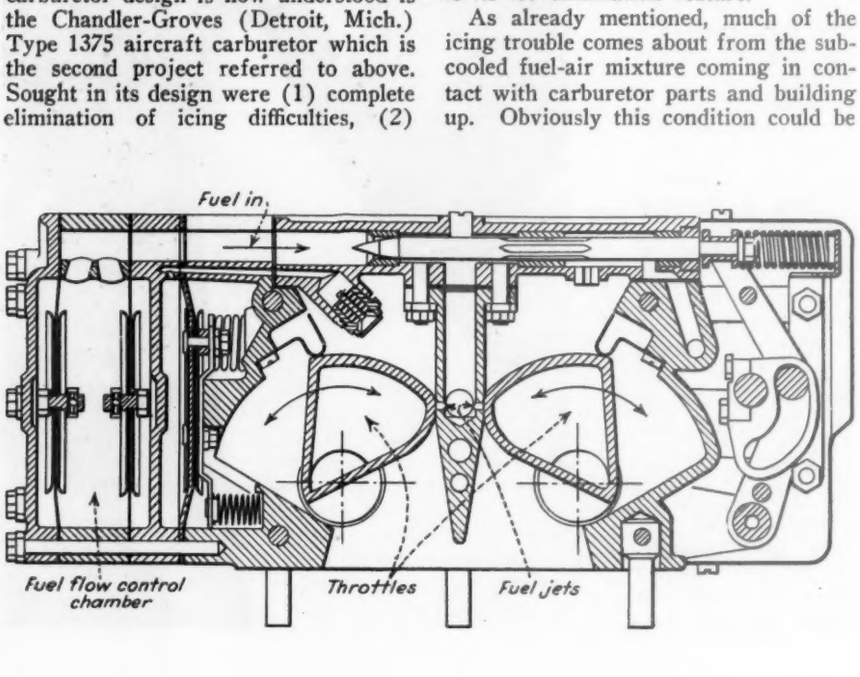
One thing which is being tried with this carburetor is the introduction of all the fuel in the central barrel, taking air only in the two outside barrels. If, in spite of heat and alcohol injection, ice does form in the center barrel, the two outside barrels will always be open so that the full air supply cannot be choked off.

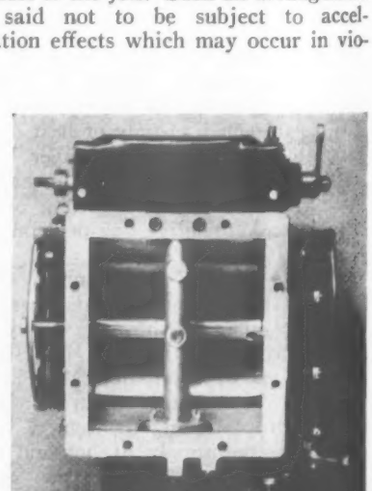
Chandler-Groves project

Completely unconventional as far as carburetor design is now understood is the Chandler-Groves (Detroit, Mich.) Type 1375 aircraft carburetor which is the second project referred to above. Sought in its design were (1) complete elimination of icing difficulties, (2) satisfactory operation in any military manoeuver, (3) ease of calibration and flexibility of construction, (4) good mechanical life and freedom from corrosion and (5) easy and economical manufacture. In view of current demand, experimental effort was concentrated on a carburetor for an engine up to 1,250 hp. Although this carburetor incorporates a number of novel ideas which have to do with the control of fuel flow and mixture, of principal interest here is its ice elimination feature.

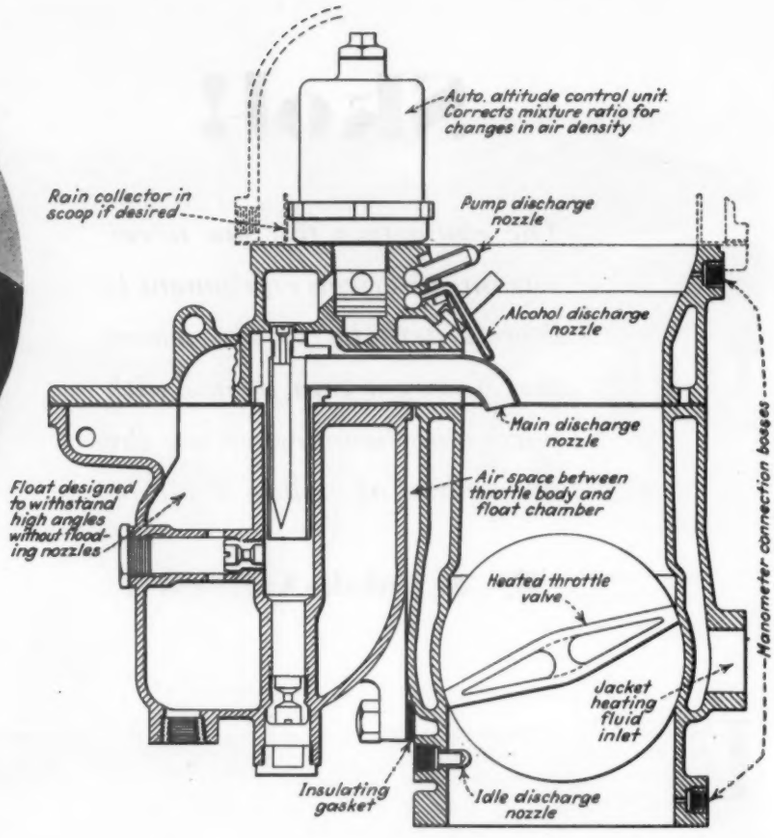
As already mentioned, much of the icing trouble comes about from the subcooled fuel-air mixture coming in contact with carburetor parts and building up. Obviously this condition could be improved if the fuel-air mixture could be made to leave the carburetor immediately upon vaporization without further contact with it. To do this, the throttles were made in the form of two modified cylindrical sectors with the discharge nozzle located between them, so arranged that the throttles formed the venturi as well. With this construction the fuel leaves the discharge nozzle and encounters no further valves or restrictions within the body of the carburetor. Very little heat can be taken from the metal of the carburetor by the vaporizing fuel and as a result the temperature of the body is consistently higher than for conventional types. It is possible to heat the throttles by circulating some heating medium through them, but so far, tests have proven that it is scarcely necessary. In over 100 hours of test work under all weather conditions the carburetors have never become fouled with ice, even though no heat was applied either at the scoop or at the engine adaptor. There is no doubt but that ice does form after passage through the venturi section, but it passes immediately into the engine adaptor and thence into the blower section where it is immediately broken up and can do no harm.

Another interesting feature of this equipment is a fuel metering device actuated in conjunction with the throttle movement through a very simple slotted type cam. The float chamber arrangement (or lack of it) also deserves special mention. A pair of flexible diaphragms connected up by suitable linkages to ball type valves control the flow of fuel to the jets. Such an arrangement is said not to be subject to acceleration effects which may occur in vio-





The Chandler-Groves non-icing carburetor. Above: Looking down through carburetor, throttles open. Fuel supply and metering device are in the tube shown as vertical in the picture. Left: cross section through the carburetor showing variable venturi throttles, and diaphragm type fuel control which replaces conventional float chamber.


Auto. altitude control unit. Corrects mixture ratio for changes in air density
Rain collector in scoop if desired
Pump discharge nozzle
Alcohol discharge nozzle
Main discharge nozzle
Air space between throttle body and float chamber
Float designed to withstand high angles without flooding nozzles
Heated throttle valve
Jacket heating fluid inlet
Insulating gasket
Idle discharge nozzle
Manometer connection bosses

Irving R. Metcalf of the Bureau of Air Commerce points out some of the features of the latest Bendix-Stromberg non-icing carburetor shown schematically at right. Note the alcohol injection tube immediately over the main fuel jet.

lent manoeuvers with the float type control. As with the Stromberg unit, both manual and full automatic mixture control are available. At present flight tests are being conducted with this carburetor installed on a Cyclone engine by the Wright Aeronautical Corporation.

Direct injection

Another engine ice eliminating project which cannot be discussed here for reasons of military necessity is the direct injection of fuel into engine cylinders. This is not new, of course, as it was under development and in actual commercial operation some four years ago on Pratt & Whitney Hornets mounted in single engine mail planes of United Airlines. When United re-equipped its line with Wasp-powered Boeing 247s, the experimental work on the Hornets was dropped. Research has been carried on, however, both at Wright Field and in the NACA laboratories, but little in the way of reports is available. It is obvious, however, that if the fuel is injected directly into the cylinders or into the intake manifolds just ahead of the cylinders, there can be no icing problem.

Alcohol-fuel mixtures

The last of the three developments sponsored by the Bureau of Air Commerce has to do with the burning of non-freezing fuel mixtures in conventional carburetors. The most common fuel combination answering this description is a blend of alcohol and gasoline, but there are inherent difficulties in the way.

Mixtures of alcohol and petroleum by-products are ordinarily very unstable, breaking down readily, especially in the presence of moisture. The chief problem therefore has been to develop stabilizing compounds that not only make the alcohol and fuel miscible over a wide range of temperatures and a wide range of moisture conditions but, at the same time, still be efficient as a fuel. As announced recently (AVIATION, April, 1936), a stabilizer that appears to produce these desirable results for alcohol-fuel mixtures has been developed by Dr. C. C. Callis.

The fuel consists of a blend of alcohol and gasoline (or aviation naphtha) that is stable and operative at temperatures as low as —40 deg. F. It is claimed that the stabilizing compound is effective over a wide range of alcohol fuel mixes and that it is effective in the presence of many types of anti-knock compounds. The lead susceptibility of the basic fuel is said not to be affected adversely by the stabilizer. Certain Bureau of Standards tests indicate that the stabilizer itself has a value as an anti-knock compound, tending to raise the octane rating of the basic fuel.

Complete tests were made at the Guggenheim School of Aeronautics in New York and showed an average increase of about 25 per cent in consumption with a power loss of only about 1 per cent. Ice prevention and de-icing tests have all been reported as positive. The Bureau of Standards in conjunction with the Bureau of Air Commerce demonstrated that it required a period of not more than one minute to completely dissipate the ice accretion in a carburetor which accumulated enough in two minutes to slow the engine down from 1,800 to 1,100 r.p.m. The maximum time required in any single run to restore the speed of the engine to its original rate was 1½ minutes, and in most cases did not exceed 30 to 50 seconds.

No special equipment is required for making the compounded mixture and the elements involved are said to be relatively inexpensive. Also, tests indicate that the mixtures are non-corrosive with respect to ordinary aircraft materials.

From an operating standpoint, if the fuel should prove practical, it would simplify certain problems. The stabilized alcohol fuel blend might be carried in a separate tank on board the airplane and when icing conditions were indicated, or if icing had already started, the fuel supply to the carburetor could be switched over to the blending tank simply by operating a two-way valve. After the ship had passed out of icing conditions, it could be switched back onto its normal fuel. Further tests are being conducted with these blends and more detailed reports should be available in the near future.

Skol!

The claim that the sun never sets on American equipment is literally true in Norway where the Midnight Sun beams with particular beneficence on the operations of Arilde Wideröe

By J. Falck-Andersen

IMAGINE the domestic explanations that venerable Peer Gynt would have to make to his long suffering Solveig if they had lived in the 1930's. It would have taxed his ingenuity tremendously to justify his absence for years when the places he visited could be reached in days by utilizing the regular air services in conjunction with those operated by Wideröe's Flyveselskap A/S. In fact he could have had himself deposited by airplane almost at the doorstep of his patient betrothed if the new daily schedule between Oslo and Jotunheimer had been in operation, as it will be when the concession is obtained from the Norwegian Government for a tourist service to this district which is one of the most favored retreats of sportsmen, travelers and health seekers on the Scandinavian Peninsula.

For those who would follow in the Peer Gynt footsteps, Flight-Lieut. Arilde Wideröe runs daily service between Oslo and Stockholm and summer service between Oslo and Arendal on the south shore of Norway with stops at popular watering places along the route. Night mail service between Oslo and Gothenburg is also on the program. An aeronautical version of our popular "ski" trains has been another attractive addition to the Wideröe services.

But passenger operation is only one division of activity of Wideröe Flyveselskap. The Norwegian Government has provided the company with a subsidy for student training in preparation for both sport and transport licenses and all students so far graduated have qualified for their respective licenses before the Board of Officially Appointed Censors. A club house for students and company employees and two new hangars were built about a year ago at scenic Ingierstrand, famous watering place in the Oslo Fiord, where the summer base of the company is located. One of the club house rooms has been placed at the disposal of the Norwegian Aero Club for meetings and summer week end gatherings.

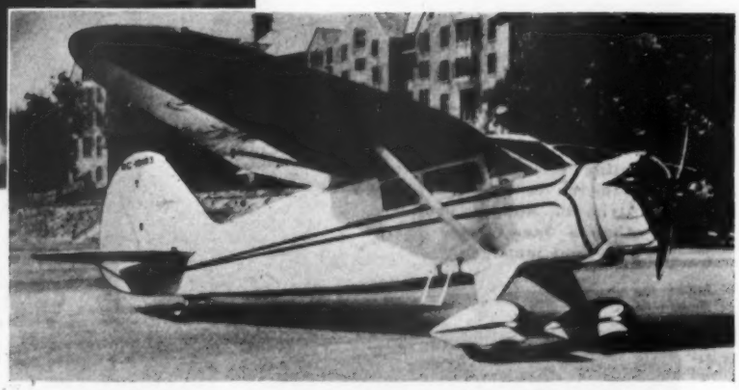
Ski-train prototype. Arilde Wideröe (center) has found it profitable to transport skiing parties by airplane. On his left is O. L. Borgersen of Seattle, member of the U. S. Olympic ski team.

Photography and aerial survey work are also included in the activities of Wideröe's Flyveselskap. Industrial plants and points of scenic grandeur in the southern and western parts of Norway were photographed in large numbers last summer and, at the same time, the survey division mapped the entire county of Hjelme with highly satisfactory results. This work is scheduled for expansion.

Problems associated with wheel type landing gears are unknown to Wideröe's Flyveselskap. Floats and skis constitute the undercarriage equipment for its rapidly growing fleet of American built airplanes. Waco cabin ships have been

Ingierstrand in Oslo Fiord, Summer base of Widerŏe's Flyveselskap.

Warming up a Waco. A kink for operators in cold countries.



Two Stinson Reliants like this with ski and float equipment and Wright Whirlwind engines have been ordered for charter service.

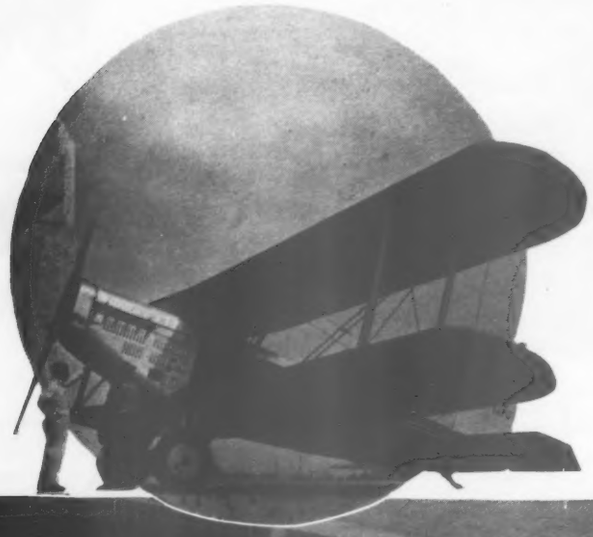
Below: Seaplane instruction at Ingierstrand in a 125 hp. Warner powered Waco Model F.

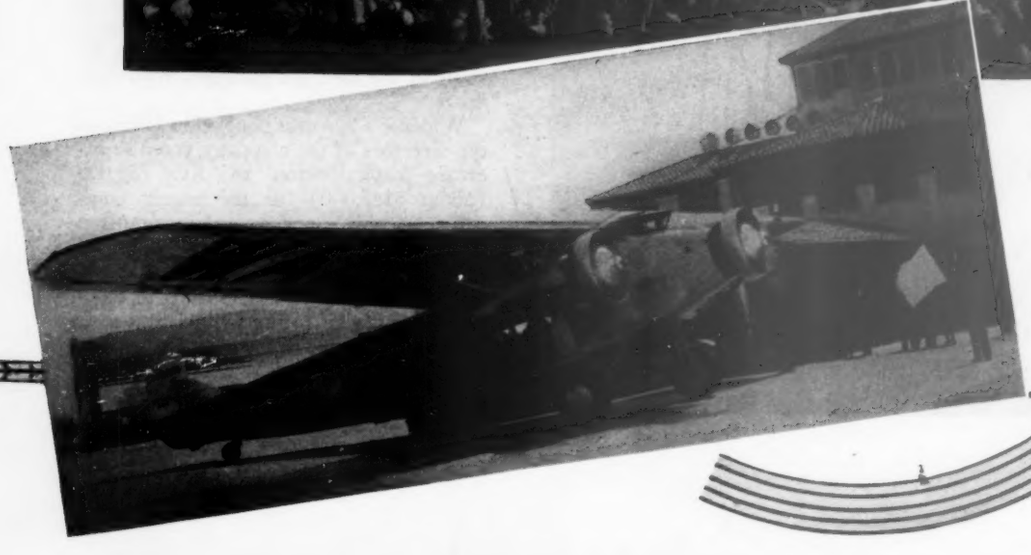
used extensively for charter flights, and open Waco F's and Gypsy Moths for student training. A 7-passenger Bellanca ship recently delivered will probably be used in the projected scheduled operations. American equipment on order at present includes two Stinson Reliants with Wright Whirlwind engines. All ships in the fleet are equipped with Edo floats.

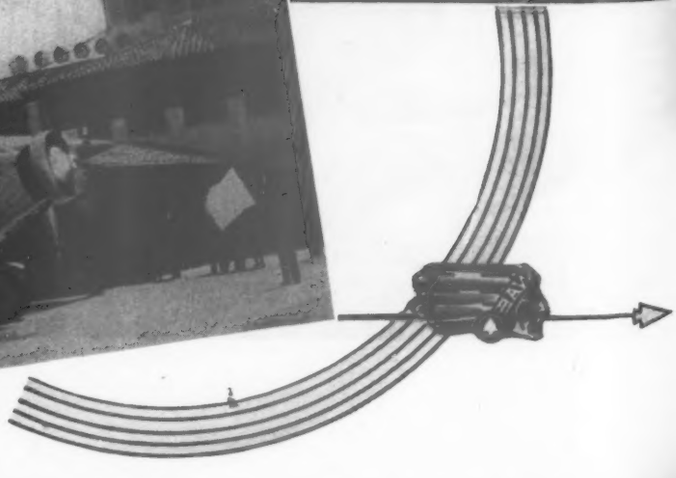
Widerŏe's business doubled in 1935 and the directors of the company voted to increase capitalization to Kr. 750,000 (about $185,000) for the parent company. A subsidiary was also organized in Bergen with a fully paid-in capital of Kr. 100,000 (about $25,000). Lieutenant Widerŏe, who has just returned to Norway after a visit to the United States, is technical manager of the company. General manager is Viggo Widerŏe, a pioneer among the younger aviation operators.

Congratulations!

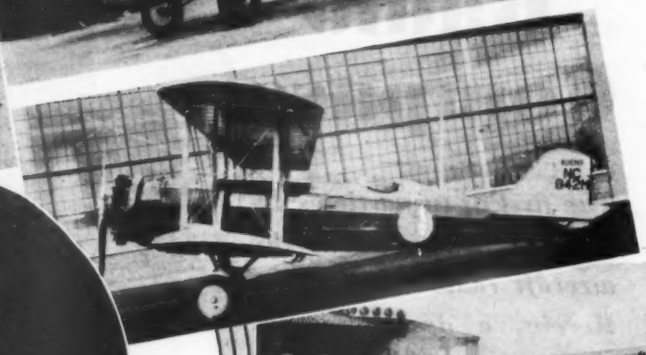
TO UNITED, to AMERICAN, to WESTERN AIR on their tenth birthdays! Ten years is a long time in aviation. Ten years has seen air transportation change from an uncertain groping about in uncharted air by adventuresome pilots in flimsy crates, to a great industry whose swift ships shuttle day and night from coast to coast over lighted airways and on invisible radio tracks. Herewith a few glimpses of the past decade. What the next will hold is a job beyond our desire to prophesy.

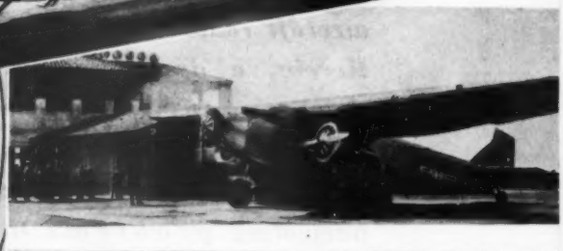


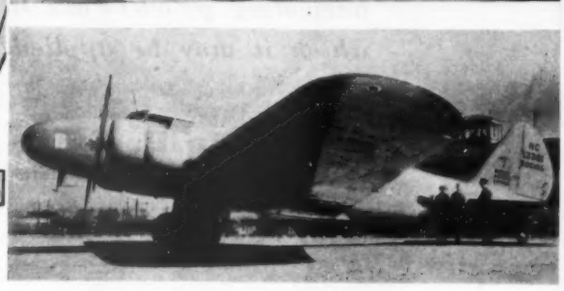




Ten years ago Jimmie James blazed the trail from Los Angeles to Salt Lake City in a Liberty powered Douglas. Five years later Fokker F-10s were carrying passengers and mail over the same route. Today Boeing 247s are doing the job. The group picture shows WAE employees celebrating their tenth anniversary. In the center (rear row) are Alvin P. Adams, president, and Jimmie James, now operations manager.

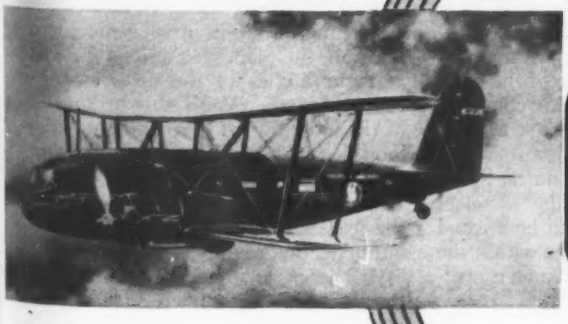






UNITED AIR LINES

Ten years and a hundred million miles of flying experience is the record of United Air Lines. Official beginning was when Pilot L. D. Cuddebeck flew the first mail from Pasco to Boise in a Swallow on April 6, 1926. Equipment changed with the years down through Boeing 40-Bs, Fords, Boeing 80s, and finally to modern Boeing 247-Ds over all UAL routes from New York to San Francisco, San Diego to Seattle. W. A. Patterson is United's president.



American Air Lines had its beginning on April 15, 1926, when a pilot named Lindbergh flew a load of mail between St. Louis and Chicago. Thereafter growth was steady until today the system stretches from Boston to Los Angeles, Chicago to Dallas. American has been the first to offer regular sleeper service to its customers. Curtiss Wright Condor sleepers are now in operation and Douglas DSTs are due shortly. Left: C. R. Smith, president.

Radio Compass

The first of two articles describing the usage of the aircraft radio compass. Herein, a description of the apparatus and its operation. In Part II, a discussion of many specific navigating problems to which it may be applied.

By John P. Gaty
Fairchild Aerial Camera Corporation

Radio compass loop on Lockheed Electra (Fairchild).

THE TERM "Radio Compass" has been accepted generally as the proper designation for visual type radio direction indicators carried aboard aircraft. Actually, the term is inaccurate, and some experienced navigators have objected to its use on the grounds that a true compass always points towards one point, the North magnetic pole. This objection is well taken. The radio compass indicates only the direction of a *selected* radio station, chosen by the pilot or operator to fit the navigational problem of the moment. Obviously, it is this very feature that makes the radio compass a valuable aid to navigation.

The utility of a radio compass corresponds closely to that of a marine peloris which is employed to establish lines-of-bearing from a ship to fixed points on the shore. The navigator is able to fix the ship's position accurately by means of geometric or graphical analysis of the bearings thus obtained. The peloris, however, is a sighting device and is limited in range by haze, fog, darkness, and the curvature of the earth. Despite its limitations, it is found on the bridge of almost all sea-going vessels. It usually takes the form of a card divided into degrees with a pair of sighting wires mounted upon a rotatable arm. The navigator aligns the sighting wires with the fixed object and reads the bearing in degrees from the card. Usually the card is rotatable independent of the arm so that it can be set to alignment with true North from the ship's compass. The peloris will then indicate true bearings which can readily be plotted on the chart.

The radio compass can be used for the navigation of aircraft in the same manner that the peloris is used on a surface vessel. Its range is not limited by murky atmospheric conditions, darkness, or by the curvature of the earth. Under good weather conditions the peloris might have a maximum usable range of 20 miles compared with a radio compass range of 300 to 400 miles. This is one of the most valuable features of the radio compass, for in the United States there are a great many radio stations within any circle with a radius of 300 to 400 miles. It is possible therefore, for the pilot to select (within certain limitations to be treated later) "clear channel" stations within the range of his radio compass under ordinary operating conditions.

Installations

The function of the radio compass is to provide a continuous visual indication of the heading of the airplane with respect to a radio station selected at will by the pilot. He may choose any radio station having a continuous or intermittent carrier frequency within the range of the compass, and from the instrument may obtain the relative bearing of that station.

A typical installation is shown in Fig. 1, and the appearance of the essential components is shown in accompanying photographs.

The visual indication is given by the position of a pointer on a meter dial with center, left and right readings. The direction of the pointer indication shows the position of a loop antenna with respect to the line of direction toward the radio station to which the compass is tuned. When the needle is in its center or zero position, the plane of the loop antenna is at right angles to the direction of the radio station. With the leading edge of the loop toward that station, when the loop is turned to the right of this position, the meter shows a right deflection. In the same way, motion of the loop to the left of the line of direction causes a left deflection of the meter. If the motion of the loop causes opposite deflection of the meter, then the front or leading edge of the loop is facing away from the reference radio station instead of towards it.

Two types of installation of the radio compass are possible, both utilizing the above principle. The simpler type has a loop which is mounted in a fixed position, at right angles to the line of flight of the airplane. This is intended for use as a

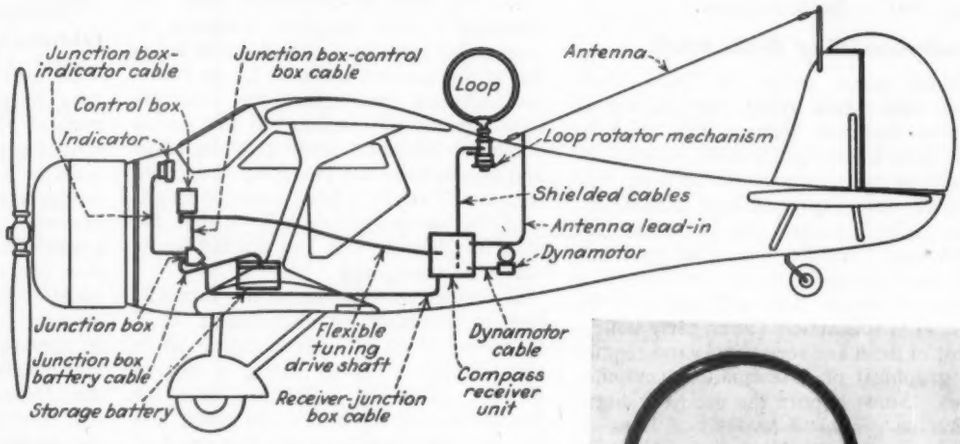
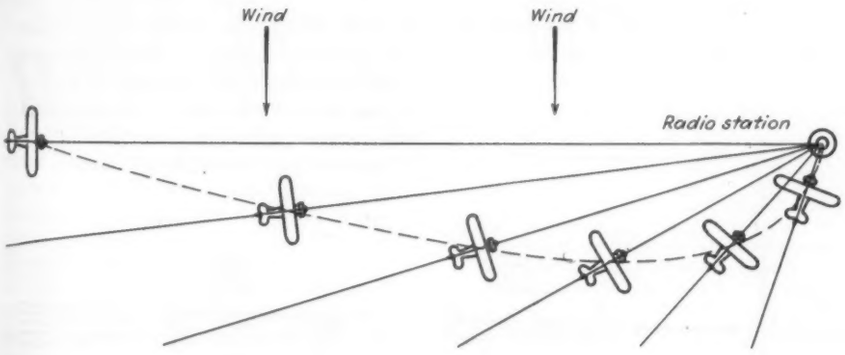
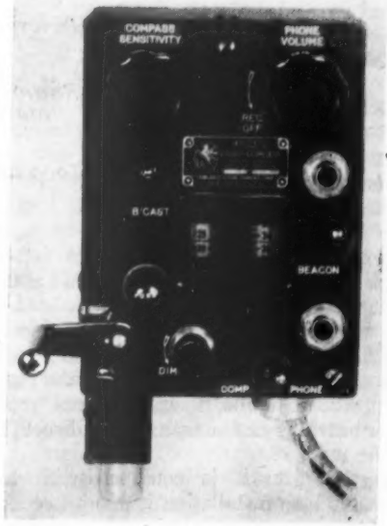


Fig. 1 (above): Typical installation diagram showing units of the Fairchild-Kreusi compass in a Beechcraft.

Principal elements of the Fairchild R.C.-3 radio compass, including loop and mounting, receiver, control panel and course indicator.

Fig. 2 (below): When "homing" in a cross-wind the approach to the radio station will be along a curved track.





"homing" compass, since the center position of the meter pointer shows that the airplane is headed directly toward the radio reference point.

The second type of installation has a loop which may be rotated about a vertical axis, independent of the airplane's heading, until a center reading on the meter is obtained. The loop position may then be read from an azimuth circle on the base of the rotatable mounting, and this will indicate the relative bearing of the radio reference point to the airplane's heading. This type loop mounting may be fixed in its zero position and used as a homing compass.

Not a homing device only

It is a common impression that a radio compass is a homing device only. It is admitted that this is the easiest and most obvious use but is far from being the only one. When homing, a radio compass indicates merely that the nose of the ship is pointed at the station. Cross-winds will cause drift and the course will deviate from a straight line, the degree of curvature depending upon the speed of the aircraft and the velocity of the cross-winds (Fig. 2). It has been stated by mathematically inclined navigators that such curvature is not important as far as the effect upon the air distance flown from point to point is concerned. Their contention is that if the aircraft were flown along a predetermined straight track, by making the proper allowance for drift, the air distance flown should practically equal the air distance flown along the curved homing course. The increase in

air distance along the curved course over the straight track is said to be less than 5 per cent in almost any case.

Predetermining flight track

Many pilots prefer to know their track even when flying over the top of a total overcast because they wish to pass close to emergency fields, avoid open water, or pass over areas offering reasonable emergency landing conditions. The radio compass can be used with confidence over the top of an overcast. The methods employed are outlined in a series of charts that will appear with Part II of this article (in an early issue). Most of them are very simple and require no graphical or mathematical computations. Some require the use of triangulation or graphical analysis of lines-of-bearing laid on the chart, preferably prior to take-off.

The radio compass alone cannot be used for anything except simple homing towards a radio station at or near the destination. In using it for actual navigational purposes it is absolutely essential to have a properly compensated and stable magnetic compass and it is very desirable to have a directional gyro. The directional gyro eliminates the inconvenience and annoyance of the swinging of a magnetic compass caused by bumpy air or abrupt course changes. A directional gyro is a necessity when a fixed radio compass loop is used, inasmuch as this type of installation requires the entire aircraft to be turned to obtain a cross-bearing, or a bearing on a radio station which is off-course. The directional gyro is not affected by the turn and therefore will give an accurate reading immediately. If a magnetic compass were used by itself, the problem of obtaining cross-bearings with a fixed loop installation would be very arduous, due to the well-known tendency of the magnetic compass to oscillate after a turn. The directional gyro also simplifies the pilot's problem considerably. He can set the directional gyro card to a true heading before beginning the measurements of the desired bearings. This is done by merely making the proper corrections for deviation and variation to the magnetic compass heading as flown along the predetermined or original course. The directional gyro will then indicate true bearings during all positions of the necessary turns and these bearings can be transferred directly to the map.

If the aircraft is equipped with a rotatable loop installation it is not necessary to swing the ship in order to obtain cross-bearings because the loop itself is swung, and the readings of the loop scale are used in connection with the readings of the magnetic compass or directional gyro to obtain the true bearing of the selected station. Large transport aircraft can utilize the rotatable loop economically because of the saving of time required to obtain cross-bearings and also because any swinging of the ship in a circle above a total overcast might lead the passengers to believe that the pilot had become lost and did not know where he was going.

A further convenience of the rotatable loop is its utility for obtaining a "fix," by means of an off-course station while the aircraft is flying along a beacon airway, (Fig. 3). In this case the beacon airway furnishes the track and the cross-bearing furnishes the point of intersection, which determines the location of the aircraft. The easiest method of obtaining such a "fix" is to set the loop to a position 45 deg. or 90 deg. from the axis of the aircraft and simply observe the radio compass indicator occasionally until the needle becomes centered. If the aircraft is in the "on-course zone" of the beacon airway at this moment, its position will be accurately known from the intersection of the off-course bearings which can be laid out before take-off. Any angle of intersection can be adopted, provided that the angle is large enough to give an accurate fix. Such lines-of-bearings can be taken ahead, abeam, or astern of the aircraft. One single off-course station can therefore be used for the purpose of establishing a series of intersection points or "fixes."

Obtaining a "fix"

In order to obtain the highest accuracy in obtaining a "fix," the proper method of laying out a line-of-bearing must be used. The true line-of-bearing must be laid out at the observed angle with the nearest meridian as known, or assumed from the dead reckoning position. The Lambert conformal projection charts as supplied by the Department of Commerce are designed for the purpose. If the station is distant it may be necessary to use one of the new original charts (9M or 10M) as supplied by the Department of Commerce, or to use their chart No. 306a which covers the entire United States and shows the location of the principal broadcasting stations. It should be remembered that the type of chart used is very important, if accuracy is to be obtained. It is suggested that anyone who contemplates using a radio compass for aerial navigation obtain a copy of "Practical Air Navigation" by Thoburn C. Lyon. This may be ordered from the "Director" Coast and Geodetic Survey, Washington, D. C. (30 cents). This book is new, and contains many useful graphs and curves, as well as complete information regarding the proper methods of using charts for position determination.

In Part II of this article the author will present a series of charts showing navigation problems that may be solved by the use of the radio compass and will discuss certain factors which affect the accuracy of readings obtained.

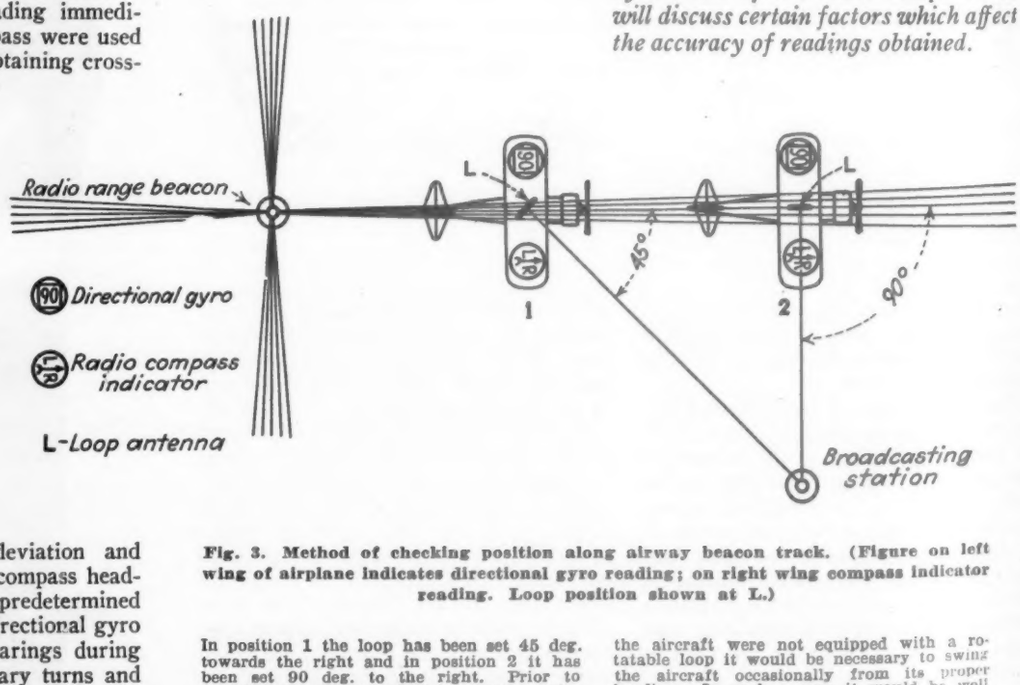


Fig. 3. Method of checking position along airway beacon track. (Figure on left wing of airplane indicates directional gyro reading; on right wing compass indicator reading. Loop position shown at L.)

In position 1 the loop has been set 45 deg. towards the right and in position 2 it has been set 90 deg. to the right. Prior to reaching the predetermined intersection point (of the beacon on-course zone and the radio bearing) the radio compass needle will indicate to the right of center and after passing it will indicate to the left. If the station were to the left of the course the needle action would be reversed. The "fix" is determined when the needle is centered. If the aircraft were not equipped with a rotatable loop it would be necessary to swing the aircraft occasionally from its proper heading. In such a case it would be well to draw a large number of intersections on the map prior to the flight. If no beacon is available, cross-bearings can be taken on two or more stations and the intersection of these lines-of-bearing will determine the position of the aircraft with a reasonable degree of accuracy.

Winding up a series of four articles on the theoretical and practical aspects of the flutter problem, the author derives formulas for balance coefficients, and makes some practical suggestions relating to flight test technique

Flutter

By
Manfred Rauscher
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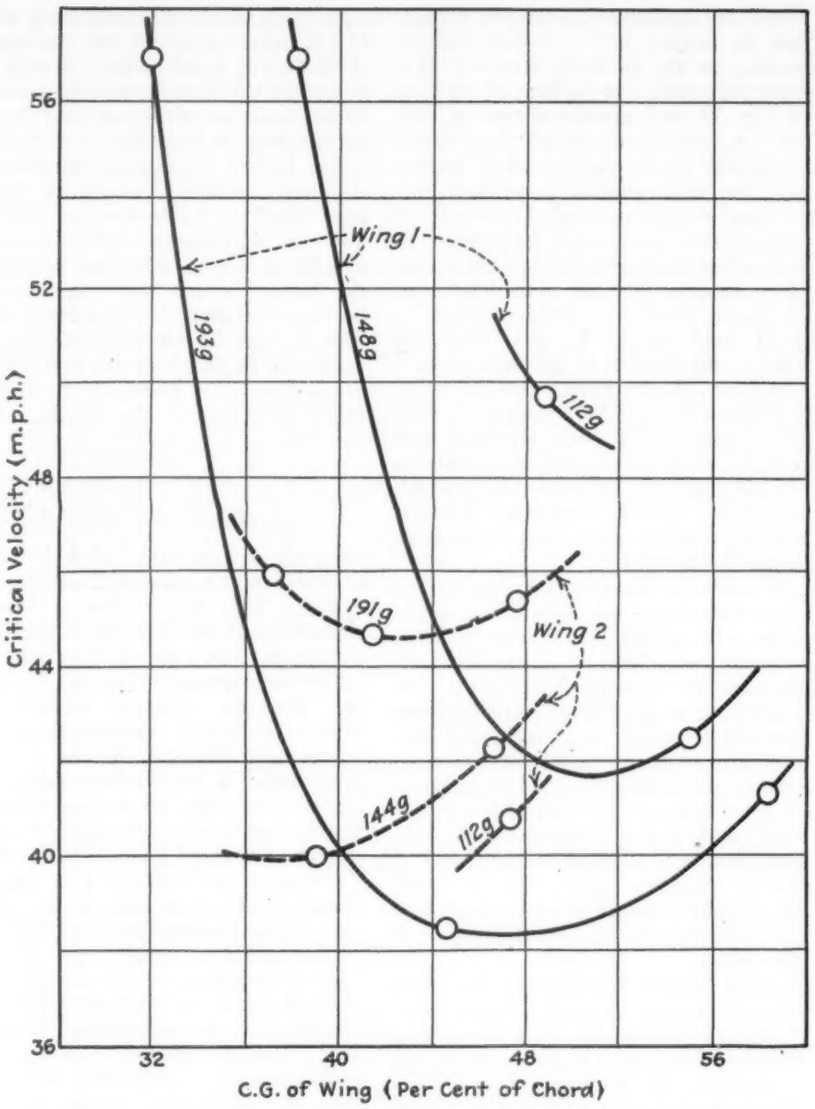


Fig. 19: Effects of flexural stiffness, C. G. location and mass on critical speed of flexural-torsional flutter. Model wings, 30x5 in. Wing 2 is twice as stiff flexurally as Wing 1. Wing mass in grams. (From Bailey and Bentley, "Effect of Flexural Stiffness on Flutter," M.I.T. 1934.)

WHILE dynamic overbalancing of the movable surfaces is the only way of curing flutter completely, the airspeed at which flutter would actually start if balance were not provided depends on many factors, the most important of which deserve to be discussed in some detail.

The desirability of a maximum of torsional stiffness has already been mentioned and needs hardly be elaborated upon. The less the wing twists under given flexural accelerations, the less tendency there will be toward flutter. But while torsional stiffness is definitely a good thing, its value has sometimes been overrated. For even if the wing were absolutely rigid in torsion, flexural-aileron flutter could still develop. Since the principal danger normally lies in just that type of flutter, there is little point in equipping a wing with a double drag truss or a rigid covering if the ailerons are left unbalanced. As a matter of fact, some of the worst cases of flutter on record have involved wings with solid covering—probably as stiff in torsion as anything likely to be built. The suggestion offered here is, therefore, that mass balancing of the ailerons, as the simplest, cheapest and usually most effective measure, should always be considered first. Usually there will remain little justification for increasing the torsional rigidity of the wing beyond the amount needed to avoid a straight divergence or an excessive deflection under static aileron loads at high speeds.

The rôle played by flexural stiffness is not so readily understood. The more violently a wing snaps back and forth in flexure, the greater are the inertia loads, and hence the twisting moments, to which it subjects itself. On the other hand, the duration of the loads is decreased, and the aerodynamic damping of the flexural motion is increased, leaving the net effect difficult to assess. Tests on two wings of similar torsional stiffness but different flexural rigidity confirm the fact that the effect of flexural stiffness is very complex, beneficial under some conditions and detrimental under others (Fig. 19).

Fig. 19 also emphasizes the importance of location of the wing C.G. relative to the elastic axis. While it is scarcely practical to move the C.G. of a given wing to reduce the flutter hazard, the relative desirability of several forms of construction may well be judged, among other things, by the position of the C.G. with respect to the elastic axis. Engines mounted on a wing not only move the effective C.G. of the adjacent portion of the wing forward, but tend to produce something like a node at their station—both effects being generally on the helpful side. Wing tanks are not likely to have much influence on flutter so long as they do not extend very far out into wing. If they do, the critical speed may be seriously affected, as appears from Fig. 19.

The common belief that the ratio be-

tween the natural frequencies in torsion and in flexure has a rather definite bearing on the fluttering tendency of a wing suggested a re-plotting of the data of Fig. 19 in a manner shown in Fig. 20. A general rising of the critical speed with the frequency ratio is apparent; but the variation is neither pronounced enough nor definite enough to suggest that the natural frequencies in themselves determine the critical speed. It is obvious that the spread between the points could have been increased a great deal simply by providing the wings with ailerons of different sorts.

Aileron displacements due to wing deformations may be a source of danger, especially if both torsional and flexural wing movements contribute to the aileron displacements. In general, therefore, such a "coupling" between aileron motions and wing deflections should be avoided.

Friction in the control system is another factor that may be of some importance. By nature, this friction is likely to be of the "solid," or "static" kind. It then has the effect of clamping the controls more or less firmly until they are knocked loose by some incidental disturbance at a speed well in excess of that at which flutter would have begun in the absence of friction. Flutter thus starts with violent abruptness and structural failure is likely to occur before it can be stopped. Static friction should be reduced to a minimum by the use of ball bearings in all movable parts of the system.

Some benefits are obtained from fluid friction devices, such as oleo plungers, whose opposition to a control movement increases with the rapidity of the movement. By dissipating energy they retard the development of flutter. They do not provide any actual clamping of the controls under gentle motions, and hence allow flutter to develop gradually at whatever speed it can maintain itself if started. Such devices also help to suppress control vibrations caused by resonance.

Balance coefficients

Complete dynamic balancing of control surfaces is an absolute necessity. The designer would do better to spend his ingenuity on devising light means of complete balancing than on trying to discover the lowest degree of balance that would safeguard him—and then adopting some uneconomical way of providing it. But since the lightest balancing devices will always become lighter yet if the balance they have to provide can be reduced, interest in partial balancing is bound to persist, and a few words about the use of "balance coefficients" appear, therefore, justified.

A balance coefficient is a figure purporting to give the ratio between the unstable shaking tendencies of an aerodynamic surface and the stabilizing effects of a balancer connected with the surface. A coefficient equal to unity would thus mean that the damping and the upsetting forces were exactly equal, and that the surface was on the point of fluttering—while higher coefficients would mean definitely unstable motions and lower ones definitely stable motions. To have any real significance, such a coefficient should, of course, take into account all the factors which have an important bearing on flutter. It seems futile, therefore, to hope for much significance in a coefficient as simple as one recently proposed (by T. A. Roché, at the International Congress of the S.A.E., 1933), namely,

$$k = \frac{\text{Product of Inertia of Movable Surface,}}{(\text{Area of Surface})^2 \times (\text{Mass of Surface})}$$

although a low value of k is clearly desirable under otherwise similar conditions. That this coefficient does not signify anything in itself is borne out by the fact that no definite and generally appropriate value can be given for it—some surfaces having been found satisfactory with relatively high values and others unsatisfactory with low ones. A type of coefficient that might conceivably mean something—although how much could only be told by experience—may be derived as follows:

Consider, as a simple first case, the flutter of a vertical tail, involving torsion of the fuselage and flapping of the rudder about its hinge. Let ν be the natural frequency of the oscillations of the tail about the fuselage axis; θ the amplitude of the oscillations; h the distance from the fuselage axis to the tip of the fin; A the area of the fin and rudder; K the product of inertia of the rudder about its hinge line and the fuselage axis; I the moment of inertia of the rudder about its hinge line; V the velocity of flight; and ρ the density of the air. Assume the rudder to be free from any restraints on the part of the pilot. Then the damping effect on the fin and rudder, considered as a unit, will be

$$\text{Damping Moment about Fuselage Axis} = \gamma_1'\left(\frac{\nu h\theta}{V}\right)V^2Ah,$$

the quantity $\nu h\theta/V$ being a measure of the change in the effective angle of attack of the tail at a typical station, and γ_1' representing a suitable numerical factor. The upsetting effect is

$$\text{Upsetting Moment about Fuselage Axis} = \gamma_1''\left(\frac{\theta K}{I}\right)V^2Ah,$$

where $\theta K/I$, measures the angle the rudder deflects under the accelerations (the moment on the rudder varies as $\nu^2\theta K$; the angular acceleration of the rudder varies as $\nu^2\theta K/I$; the duration of the impulse varies as $1/\nu$; the displacement varies as the acceleration and the square of the time, or $\theta K/I$), and γ_1'' is another numerical factor. Thus, the balance coefficient k_1 is

$$k_1 = \frac{\text{Upsetting Effects}}{\text{Stabilizing Effects}} = \gamma_1\left(\frac{KV}{\nu hI}\right),$$

where γ_1 is a new constant equal to γ_1''/γ_1'

Next, consider the flutter of a horizontal tail under similar conditions, assuming the elevators to be connected through a stiff torque tube. Since the two halves of the tail will vibrate in opposition, the flapping of the movable surfaces is restricted much more by the elasticity of the torque tube than by their own inertia. Hence, the angular deflection of the elevators will be determined principally by the ratio of $\nu^2\theta K$ to M_o, the moment required to twist the elevators through some standard angle. Thus, with the same notation as before, and with suitable new constants γ,

$$\text{Damping Moment} = \gamma_2'\left(\frac{\nu h\theta}{V}\right)V^2Ah$$

$$\text{Upsetting Moment} = \gamma_2''\left(\frac{\nu^2 K\theta}{M_o}\right)V^2Ah;$$

$$\text{hence} \qquad k_2 = \gamma_2\frac{\nu KV}{M_o h}$$

A coefficient allowing for the effects of both inertia and elastic restraint could be obtained by simply combining k_1 and k_2 in an appropriate manner. For even greater generality, it is possible also to take into account the aerodynamic restoring moment on the surface, which increases the effective elastice restraint by an amount eV^2, where e is some constant depending on the size and shape of the surface. A further aerodynamic moment on the movable portion of the surface is caused by the changes in the effective angle of attack of the whole surface (movable and fixed together)—changes which are proportional to $\nu h\theta/V$, as seen above. With μ the rate of change of the hinge moment with angle of attack, referred to unit velocity of the air stream, the moment in question becomes $\gamma_3\mu\nu hV\theta$, γ_3 representing a suitable factor of proportionality. This moment tends to deflect the movable surface, and its effect is therefore similar to that of the dynamic moment $\nu^2K\theta$. Thus, combining k_1 and k_2, there is obtained a coefficient

$$k = \gamma_2\frac{\nu KV + \gamma_3 uhV^2}{h(M_o + e_1V^2 + \gamma_2\nu^2 I/\gamma_1)}.$$

This coefficient becomes equals to k_1 or k_2 if the aerodynamic hinge moments are neglected while preeminence in the denominator is given to either M_o or I, i.e., under the conditions for which these coefficients were originally set up. It may

also be observed that for relatively low values of V, the coefficient becomes approximately equal to

$$k\,(V\,\text{small}) = \gamma_2 \frac{\nu KV}{h(M_o + \gamma_2 \nu^2 I/\gamma_1)}$$

while for very large V's

$$k\,(V\,\text{large}) = \gamma_2 \gamma_1 \left(\frac{\mu}{\varepsilon}\right),$$

suggesting that in the first case it is the elastic and the inertia constants of the system that are most important, while the second case is controlled chiefly by the aerodynamic features—more particularly the aerodynamic balance. The expression for k further indicates that for low natural frequencies, a change in ν may be either helpful or detrimental; but that for very high ν's, k tends toward

$$k\,(\nu\,\text{large}) = \gamma_1 \frac{KV}{\nu hI} = k_1,$$

thus approaching zero as ν increases beyond all limits, and suggesting that fuselage stiffness does become definitely helpful if it can be made very high.

Compared to the simple coefficient mentioned at the outset, the one just proposed may appear hopelessly involved. But the hard fact is that once flutter is not banished altogether, the calculation of its actual menace becomes difficult—and too short a short-cut simply will not lead anywhere. Even the coefficient suggested is not at all certain to be comprehensive enough. If it is, the experimental and statistical determination of the three constants γ_1, γ_2, and γ_3 should pay well for itself. Following the same general lines, a coefficient of aileron balance could then readily be derived—and the method extended to cover the whole field of flutter. But before such an extension becomes justified, the basic soundness of the method ought to be tried on the relatively simple problem just discussed.

Flight test technique

Flutter testing should begin as soon as the general stability and control characteristics have been ascertained in cautious preliminary flights and should precede the general performance and service testing of any new or altered airplane. In these tests, all controls should be provided with stops adjustable by the pilot who, in changing from one flight condition to another, should cautiously move the stops along with the controls, ready to hold incipient flutter down at any moment. Such stops should be put not only on the control stick and the rudder bar, but also on the surfaces themselves. The airplane should be rigged slightly tail-heavy, and the pilot should set the forward stop on the elevator control where he can hold the stick loosely against it, leaving at the same time enough play behind the stick to allow the airplane to pull up gently in the event that the pilot's hold should suddenly be shaken off by flutter. To give full freedom of action under any emergency arising from causes other than flutter, means ought to be provided for releasing the control stops instantaneously.

Testing for flutter should preferably be done when the air is not too smooth; flutter may then appear in jerks before it can maintain itself steadily. The speed increments between successive tests should be small, and all tests should be run at full throttle (or as near full throttle as possible), so that the airplane may immediately be decelerated by closing the throttle if flutter should set in. If the pilot is able to work the controls in spite of the flutter, he may aid the slowing down of the plane by sideslipping as much as the control stops will allow — except, of course, when the flutter is tail buffeting, which generally grows worse in a sideslip. In no case should the plane be pulled up abruptly; for while yaw leaves regular flutter unaffected, a marked increase in the angle of attack may have a disastrous effect — not only because the flutter itself is likely to become more violent (Fig. 21), but also because there is an increase in the static deflections on which the vibration is superimposed.

The figures for this and the preceding three articles were kindly drawn by J. B. Kendrick.

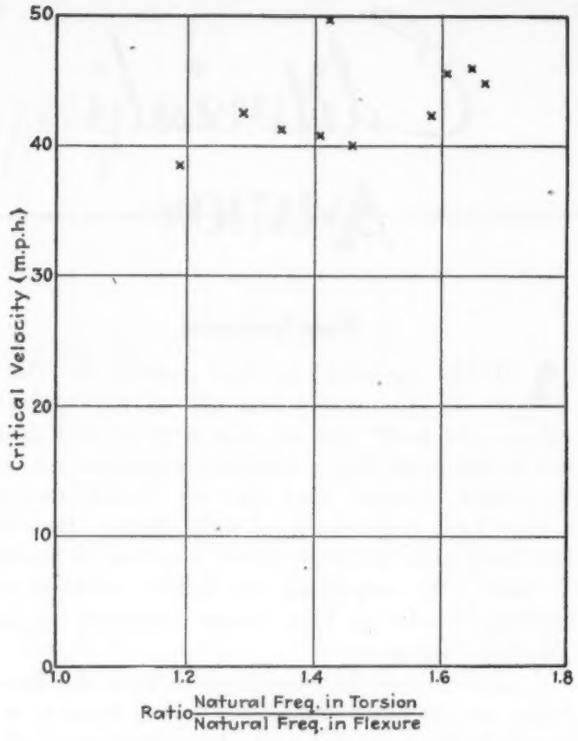


Fig. 20: Dependence of critical speed of flexural-torsional flutter on ratio between natural frequencies (from same source as Fig. 19).

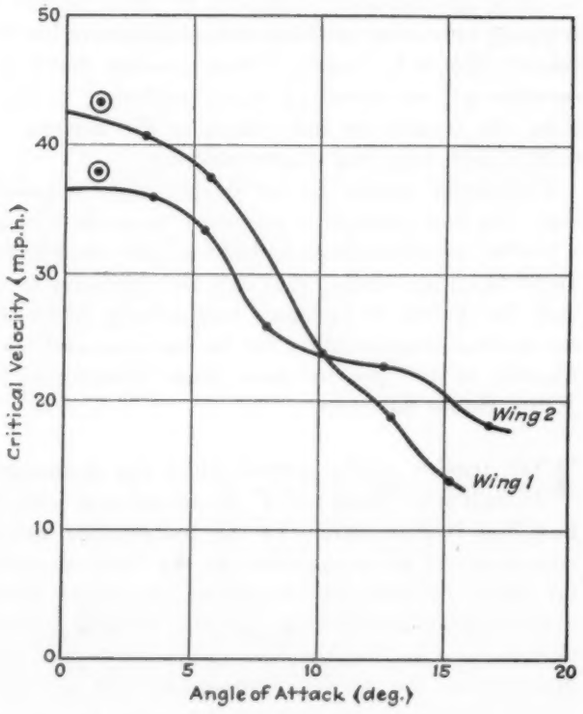


Fig. 21: Critical speed vs. angle of attack for two typical model wings. The two points in circles were obtained with the airplane model just carrying its own weight at the critical speed, without any restraint on its vertical and angular motions. The curves correspond to a fixed fuselage. Throughout the tests, failure of the wings would have occurred at speeds approximately 5 m.p.h. above the critical speed—the amplitude then approaching about one chord length at the tips.

Editorials

AVIATION

Fogbound

ALL the fog problems that concern the Bureau of Air Commerce are not of meteorological origin. So much hot air has been blasted against the Department that a zero-zero condition has been developed around most of the issues involved. Causes have been confused with effects. Personalities have been pilloried where a system is basically at fault. By employing the tactics of little boys chalking insults on back fences confusion has been piled on confusion.

It is no secret that conditions within the Bureau today are far from satisfactory. In it there is to be found little *esprit de corps*. Lines radiate in all directions, to the White House, to Senator This and Congressman That, getting inevitably tangled in the process. Everyone, from top to bottom, must move with extreme caution, knowing that whatever he does, or whosoever's errands he runs, he will be tripping over some of them and endangering his own future. But it is a waste of time (except that is is a sure-fire way of attracting cheap publicity) to try to hang the trouble on individuals in the Bureau. It makes good copy but it gets nowhere.

Underlying causes go far deeper than personalities. To find them it is necessary to wade through a welter of conflicting ambitions and complicated political backgrounds. But it is not necessary to dig very far before it becomes increasingly plain that the path of responsibility for the creation and maintenance of the present mess leads directly to the White House doorstep.

THE trouble really started when the Aeronautics branch was "Farley-ized" in accordance with the best New Deal tradition that has put political indebtedness ahead of competence as the basic yardstick for office holding. Even among deserving Democrats it should have been possible to have found a man better fitted for the Undersecretaryship of Commerce than the original appointee, but he was a "before-Chicago" man who had to have his reward.

That was bad enough, but on top of that the administration made its most serious mistake in appointing his five chief subordinates for him. Worst of all, at least four of the five were openly ambitious (and had strong political backing) to become Director of Aeronautics, a post that was not filled at once but was dangled temptingly in front of them all for some months. If there ever was a stage set for a political battle royal, it was in the Bureau of Air Commerce in 1933. The knives were out from the beginning, and even after the directorship was filled, ancient rivalries could not be forgotten and still exist today to the greater glory of Farley and the greater plague of the aircraft industry.

Whatever may have been the faults of the old Aeronautics branch, it at least functioned as a unit, it was a working organization. The titular head was the real head. All contacts with other functions of government were made through him, and whatever internal ruckuses may have existed were not carried outside the boundaries of the Department.

This is the picture at its worst. On the other hand, the Bureau is full of honest and competent men who have the best interests of their work at heart and who are doing important and constructive work toward the safety of flying of all kinds. One has only to look at the progress that has been made on such problems as airplane and engine de-icing and on the much-maligned light plane development (both of which are touched upon elsewhere in this issue) to see what we mean. But these men are all working under the handicap of an administration seriously weakened by internal dissension and by continuous outside meddling. How far they might have gone, working under better conditions the last three years, is only a matter for speculation.

WE have neither the desire nor the intention of backing this or that faction within the Bureau. What we want for the Bureau is a new deal that will make possible the creation of the *esprit de corps* that is essential for the proper furtherance of its work. What we must have is a concentration of responsibility in the Bureau head, the placing in his hands of the sole authority to hire-and-fire his subordinates. That is the only way to cut through the Gordian knot of politics that now entangles it.

THE final solution is in the hands of the President. Mr. Roosevelt could do a great and constructive piece of work for aviation in this country if he would consider the political debts of 1932 now paid in full and reorganize the Bureau along sound lines of authority and responsibility.

We have nothing personally against any of the men who head the several functions of the Bureau today. At best they were caught in a situation that was not of their own making. But if the only "out" is to make a clean sweep of present personnel and start again from scratch, then we are for it.

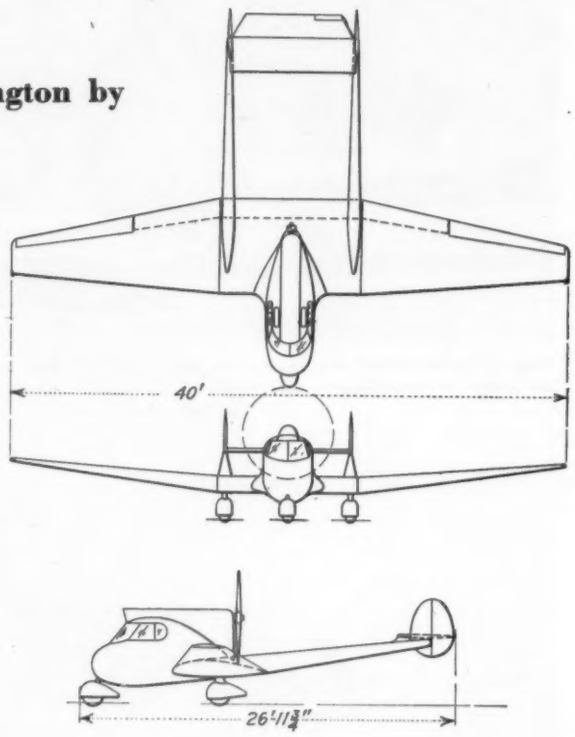
★ ★ ★

Where is the Ristine Report?

Flying Equipment

Hammond to Bureau

Revision of original Model Y flown to Washington by John Geisse for final tests



WE WERE in Washington on April 13 when John Geisse, who has been following through on the Bureau of Air Commerce light plane development program, flew in from Ypsilanti (Mich.) with the newest Model Y Hammond. We not only had a good look at it both on the ground and in the air, but we were permitted to fly it, to see for ourselves something of its interesting characteristics.

In Los Angeles in February, we had talked to Lloyd Stearman and had heard a very enthusiastic report of its behavior. (Readers will remember that Mr. Stearman had been assigned to the Hammond Aircraft Co. by the Bureau of Air Commerce to supervise modifications in the original design.) After flying the ship, we can see what he meant. No one is claiming that it is either (*a*) a $700 airplane or (*b*) the final answer to the airplane-in-every-garage problem. But it is a step, and we think a long one, toward something better for the dub pilot. Racing and transport pilots will probably pick plenty of flaws in it, but after all, it was never meant for them.

The new model is of the same general form, but differs radically in many details compared with the first Model Y we saw at the Ypsilanti factory last summer. Where the first was relatively crude in form and in finish, the second is sleek and smooth. Where the original was a composite structure of steel tubes, wood and fabric, No. 2 is all dural (except for wing cover). Where the top speed of the original fell short of the required 110 m.p.h., the second is claimed to hit 123 m.p.h., full out. In short, although the basic design remains, the whole has been completely re-engineered. And a good job done, at that.

Hoover Field was in particularly bad shape for test flying, thanks to the damage done by recent floods. Notwithstanding the roughness, John Geisse gave us a convincing taxiing demonstration, maneuvering easily with the steerable nose wheel, stopping suddenly with full application of brakes without any more alarming symptoms than increased tension on the safety belt. It is claimed that with full load and at take-off speed, the plane may be stopped by means of the brake in a distance of 140 ft.

Even with the bad field and with two on board, take-off seemed to be quite rapid. It was our first experience taking off with a nose-wheel landing gear and it seemed a bit odd not to experience the usual change in attitude during the take-off run. Best take-off seems to be obtained with the flaps part way down.

Once we left the ground, climb was very steep. When we finally leveled off and let the flaps come up, the effect was very noticeable,—the ship shot ahead as though it had been slipped into high

Latest Hammond Y as delivered to Bureau of Air Commerce.

gear. It was very comfortable to fly. At no time when we were in the air, did we touch the rudder pedals, flying entirely with the stick. Properly banked tight or wide turns may be made very easily without touching the rudders. (Characteristics without the rudders seemed so satisfactory that consideration is now being given to removing the rudder control entirely.) Stalled, she showed no tendency to slip off to one side but fell away easily, nose first, under adequate lateral control at all times. Although we did not try it, Mr. Geisse told us it was possible to throw it into a spin but practically impossible to hold it in one. There seemed to be very little difference in balance, power off or power on.

Nose-on, from which the reason for the excellent pilot vision may be seen. Note air scoop over enclosure, also housings over rear landing wheels to take care of the long oleo travel.

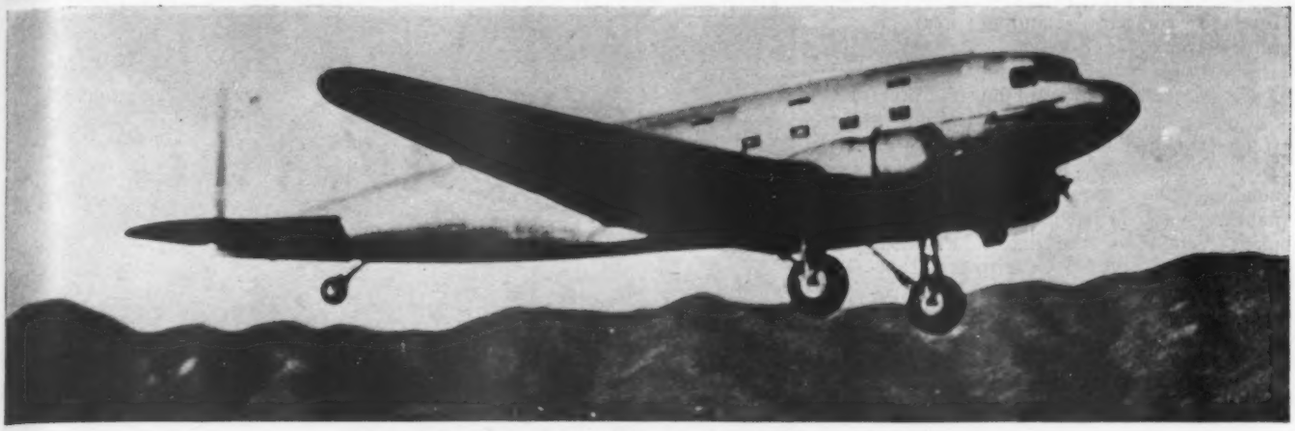
With the propeller high up and well between the tail booms, it is impossible for anyone to walk into it carelessly. (Note here also the housing for the landing gear spindles above the booms.)

Landing was an experience. To our unaccustomed eye, the approach seemed much too high, but once the flaps went down, the ship assumed a very steep path of descent (close to 45 deg.) and quickly settled down to a steady speed of between 70 and 75 m.p.h. Sitting away out in front at such an attitude the ground seemed to come up in our faces rather alarmingly, but with an easy flare just before touching down, all three wheels made contact with the ground at once, the final settling took place in the 18-in. of oleo travel and we were rolling along the field with no tendency to bounce or any feeling that the ship wanted to take off again. Brakes could be applied instantly to produce an astonishingly short roll without tendency to ground loop.

As may be seen in the pictures, vision from the cabin is very good all around, except immediately to the rear. The cabin has been finished off along automobile lines, with attractive upholstery and comfortable seating arrangement. The noise level is considerably above what might be tolerated in transport practice today, but still low enough so that conversation is not too difficult. Instrument panel is pleasing in appearance, conveniently arranged. Ventilation seems entirely adequate.

The cabin nacelle is of semi-monocoque construciton with dural bulkheads, formers, stringers and covering. Main structural members carrying the forward wheel are entirely below door level, keeping windows, doors and windshields free of heavy structural members. Engine mount is of tubular steel carried on dural bulkheads, set on top of the main wing spars. A stainless steel fire wall

The clean arrangement of tail surfaces and booms is here in evidence. Note also the flap along trailing edge.



Douglas DC-3 with 1,000-hp. Pratt & Whitney engines.

separates the engine and passenger compartment.

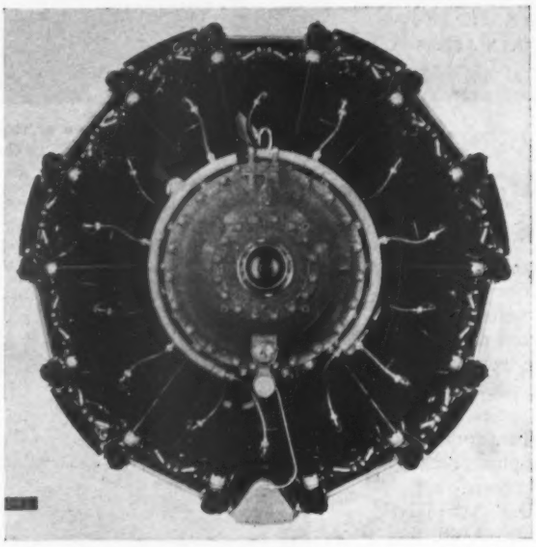
The engine is a 125-hp. Menasco C-4. Pressure type air cooling is employed, the intake air scoop being mounted above the cabin with the opening well forward so that it is not blanketed in any climbing attitude. Air is discharged through louvres at the right side of the engine cowling. No trouble has been encountered with cooling with the present cowling arrangement. Inspection doors are so arranged that the engine is readily accessible for maintenance. Two 15-gal. fuel tanks are located in the leading edge of the wing, well away from the engine compartment to reduce fire hazard.

The wing is a Clark Y, highly tapered in plan and is in three parts, the center section and two outboard panels. All boom, nacelle and landing gear connections are in the center section. It is all metal framed with fabric covering. Members consist of a large central spar with corrugated flanges and flat sheet webs to which are attached ribs of square dural tubing. Ailerons are all metal, tapered, and differentially mounted. One hundred per cent static balance is provided. Split trailing edge flaps extend over 57 per cent of the wing span. They are operated directly by a lever in the cabin through a system of push-rods and bell cranks.

Tail surfaces are all metal, full cantilever. Stabilizer is fixed, trim being obtained with a small tab on the elevator. The mounting booms are of elliptical cross-section, dural, of the stressed skin type.

Landing gear has unusual shock absorbing capacity. Goodyear air wheels with hydraulic brakes are mounted in heat treated aluminum alloy forks. The two rear wheels have shock absorbers with a stroke of 18 in. The front wheel has a stroke of 17 in. The gear is designed to take care of a vertical velocity of 20 ft. per second which is equivalent to a free drop of 76 in.

The general specifications include: span, 40 ft.; length overall, 26 ft. 11¾ in.; height, 7 ft. 7 in.; wing area, 210 sq.ft.; aileron area (total) 14.25 sq.ft.; flap area, 25.50 sq.ft.; stabilizer area, 22.45 sq.ft.; elevator area, 13.28 sq.ft.; fin area, (total) 10.50 sq.ft.; rudder area (total) 10.50 sq.ft.; fuel capacity, 30 gal.; oil capacity 3 gal.; gross weight, 2,150 lb.; useful load (including pilot and passenger, 340 lb.; two parachutes, 40 lb.; baggage 99 lb.) 479 lb. Performance: top speed, 123 m.p.h.; cruising speed, (75 per cent power) 112 m.p.h.; minimum speed, 39 m.p.h.



Newest and largest Twin Wasp rated at 1,000 hp.

Twin Wasp Douglas

1,000-hp. Twin Wasp engines to power United's Douglases

SERVICE between New York and San Francisco with only two intermediate stops (Chicago and Salt Lake) will be possible when the fleet of ten new Douglas DC-3 transports gets into operation on United Airlines. The new ships will be of the standard DC-3 type (described in AVIATION for February, 1936) with the exception of the engines which are to be the latest and most powerful of the Pratt & Whitney Twin Wasp series — the 1830 model rated at 1,000 hp. and capable of delivering 1,150 hf. for short periods of operation.

The 26 engines of this type ordered by United Airlines for installation in its new ships will represent the first commercial application of the new power plant. Previously the Navy ordered 150 of these engines at a cost of $1,764,787. The order also specifies Hamilton Standard constant speed propellers.

Two for the Navy

Vought scout bomber and Douglas torpedo bomber appear

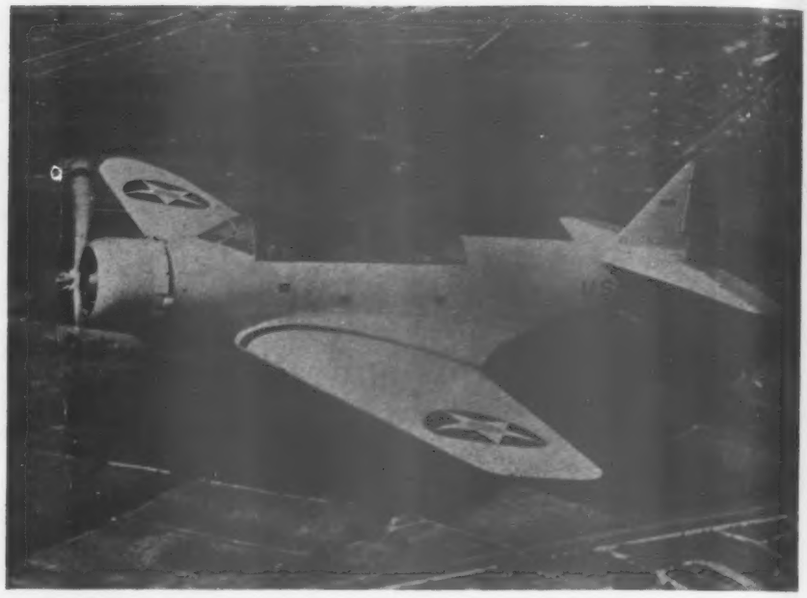
ASK anyone in the aviation business if he could identify a Vought airplane instantly and the reply would be decidedly affirmative. Then show him the picture (page 34). But a Vought it is, even though it is a low wing monoplane and, if appearance means anything, there is probably sufficient reason for the Navy to be very quiet about its performance.

The XSBZU-1 is an experimental scout bomber for aircraft carrier use. Its structure is of metal with fabric covering on the after portion of the wings and fuselage and on the movable tail surfaces. A streamlined transparent cabin completely encloses the two cockpits, and wings and tail surfaces are smoothly faired into the

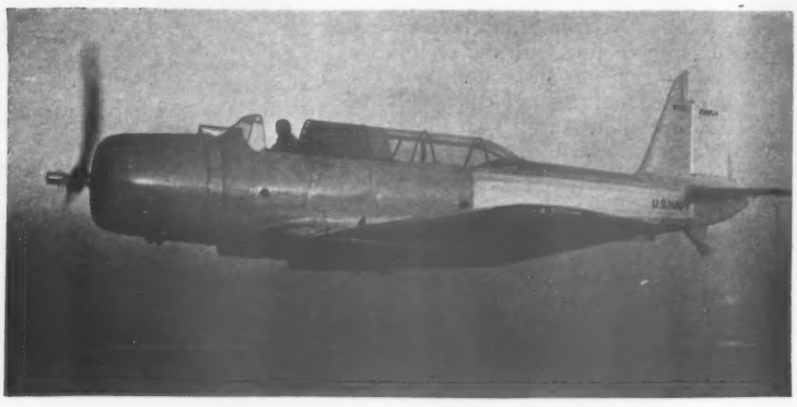
fuselage contour. Landing gear is fully retractable.

Flown from the Hartford factory to Anacostia, D. C., by Edmund T. Allen, consulting test pilot for Vought and a frequent contributor to AVIATION, the XSBZU-1 has been in competitive tests conducted by the Bureau of Aeronautics, Navy Department. The power plant comprises the latest Pratt & Whitney Twin Wasp Jr. with the Hamilton Standard controllable pitch propeller.

Also powered with a Pratt & Whitney Twin Wasp is the new Douglas Torpedo Bomber (XTBD-1) prototype of the 114 which have been ordered by the Navy at a cost of $3,636,000. These ships are of the low wing, all metal type, and have been designed for high performance in carrier operation. Further details have not yet been released by the Navy Department



One hundred and fourteen of these Douglas Torpedo bombers have been ordered by the Navy Department.



Believe it or not—a Vought (the XSBZU-1).

Taylorcraft

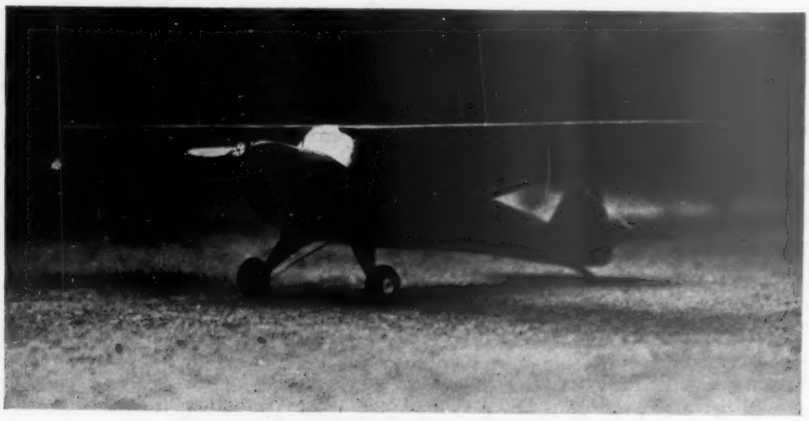
A new low-priced light plane designed by C. G. Taylor

LEAVING a business that led the field in numbers of private airplanes produced last year, C. G. Taylor, veteran light plane designer, resigned from the presidency of Taylor Aircraft recently to enter into a new venture. Located at Pittsburgh Butler Airport, the new company has been organized to produce a light high wing cabin monoplane selling for less than $1,500 and known as the Taylorcraft. Although the standard power plant is the Continental A-40, the ship is stressed for engines up to 50 hp.

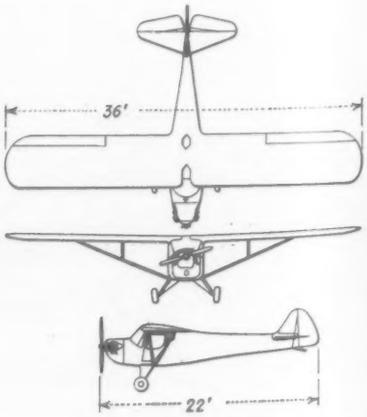
From the wing to the tail, the new ship bears the unmistakable earmarks of Taylor practice, but the nose is quite different, having a bluntness that fairs easily into ample fuselage width for a comfortable "flex-swing" seat for two persons. Automobile type doors, interior finish and upholstery are features of the design.

The cantilever landing gear contributes to the general cleanness of contour. Compression shock absorbers are mounted inside the fuselage. Wheels have Timken roller bearings and all vital points are bushed with replaceable graphite oilless bronze bearings. The instrument board and control fittings are modern to the point of setting the control wheel in the instrument board.

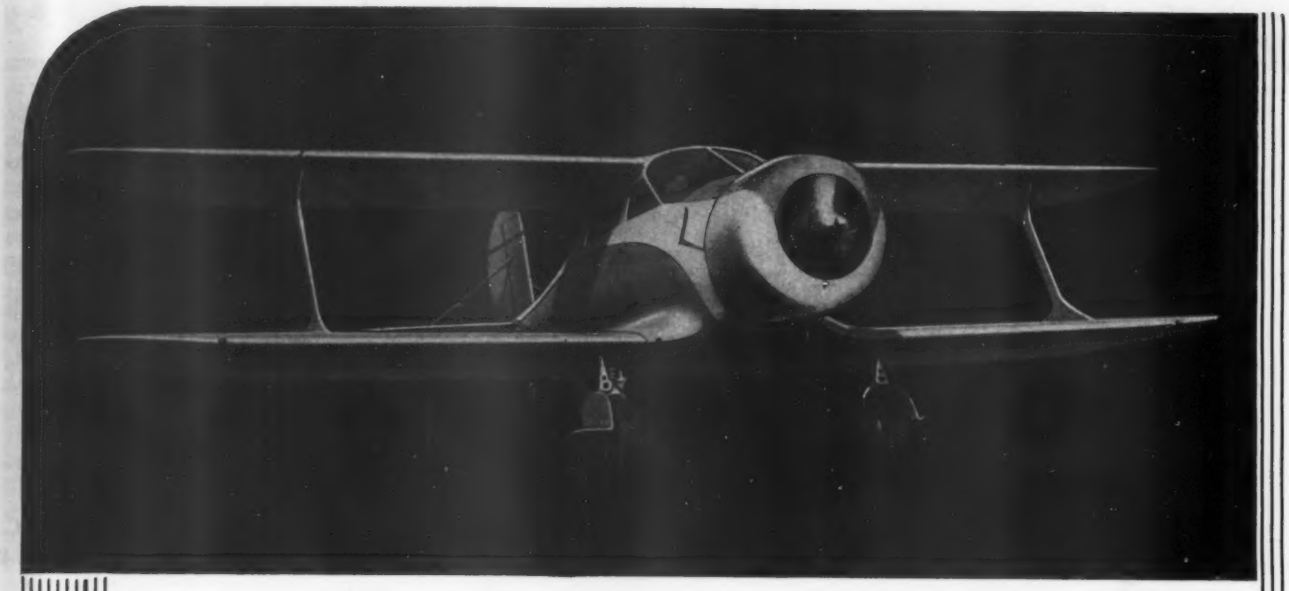
Fuselage and tail surface construction is of conventional welded steel tubing and wings are built up of solid spruce spars and metal ribs fabricated from drawn Nicral section. Standard equipment includes the Sensenich wooden propeller, Goodrich 600x6 in. tires, Shinn



Model of the Taylorcraft, by C. G. Taylor.



The new Taylorcraft.



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Beechcraft's sales for the first three months of this year were 100% ahead of the sales for the same period last year.

True, Beechcraft has been consistently improved, but steady improvement alone does not explain such a sensational sales record.

This 100% increase is the result of a fast growing confidence in the claims we make for Beechcraft performance. Owners have learned from experience that Beechcraft advertising *leans far on the conservative side.*

REMEMBER THIS WHEN YOU BUY AN AIRPLANE.

A few valuable sales territories are still open for Beechcraft representatives.

Just Off The Press

The New Beechcraft Catalog includes specifications and description of Models C17L, C17B and C17R. Write for your copy.

Model C17 Special

Here is a new Beechcraft Special at a low price.

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Model C17 Special puts Beechcraft, for the first time, in the price range with *slow speed* airplanes. Now you can have the advantage of Beechcraft's *greater economy, faster speed, extra comfort and extra safety at no extra cost!*

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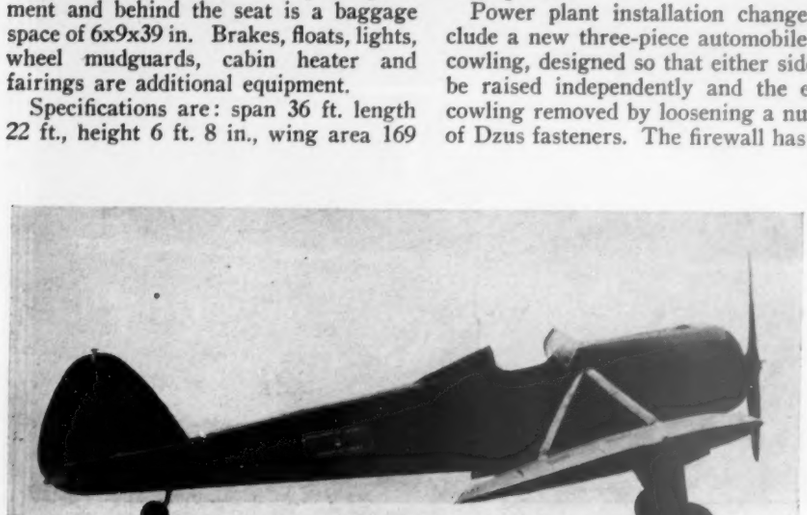
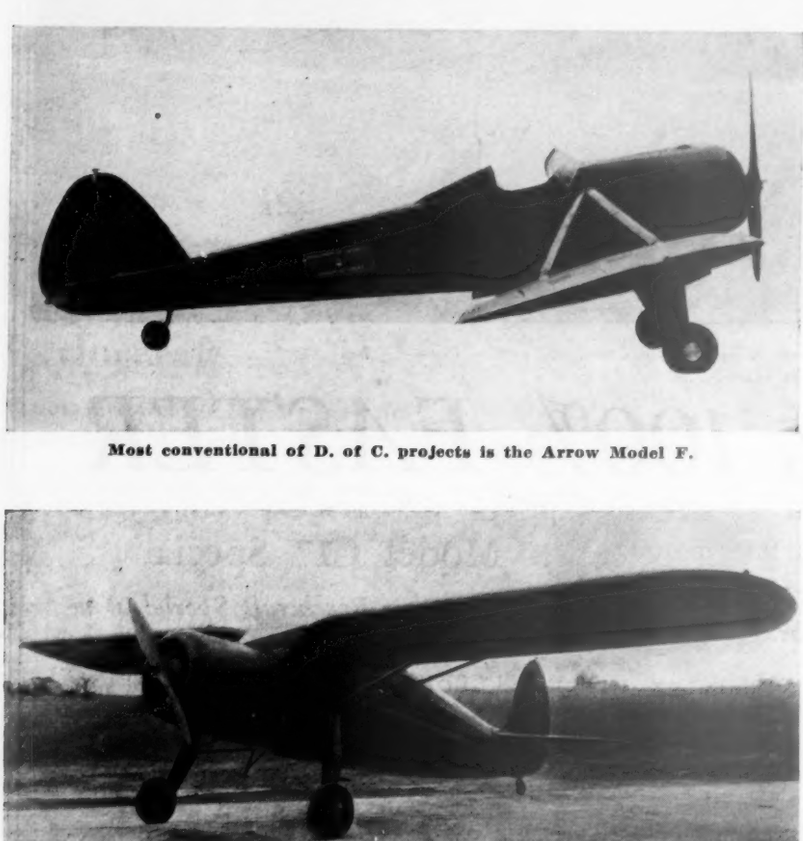
wheels, duPont Plasticelle windshield, and rubber mounted instrument panel. In the instrument panel is a map compartment and behind the seat is a baggage space of 6x9x39 in. Brakes, floats, lights, wheel mudguards, cabin heater and fairings are additional equipment.

Specifications are: span 36 ft. length 22 ft., height 6 ft. 8 in., wing area 169 sq.ft., weight empty 570 lb., useful load 420 lb., payload 181 lb., gross weight 990 lb. Fuel capacity, 10 gal.

Performance: maximum speed 90 m.p.h., cruising speed 80 m.p.h., landing speed 32 m.p.h., service ceiling 14,000 ft.; cruising range 230 miles.



Most conventional of D. of C. projects is the Arrow Model F.



The 1936 Fairchild 24 with Warner engine.

1936 Fairchild 24

New model of familiar ship has many refinements

THE 1936 Fairchild 24 has just appeared in highly refined form with a number of detailed improvements. Some of the more important changes are given below.

Appearance of the new Fairchild 24 has been improved by additional streamlining of the fuselage and greater wing tip taper. The windshield has been slanted to add gracefulness to the fuselage lines and provide better pilot vision. Interior refinements include increased leg room, one hand pilot seat adjustment, and rubber mounted instrument panel.

Power plant installation changes include a new three-piece automobile type cowling, designed so that either side can be raised independently and the entire cowling removed by loosening a number of Dzus fasteners. The firewall has been made vertical to increase the depth of the instrument panel.

Wing and tail surfaces improvements include a cantilever stabilizer rigidly attached to the fuselage structure, and elevators with trimming tabs. Operating mechanism for the wing flaps has been simplified and the control lever relocated for greater convenience. Ball bearings are used throughout the control system. Six standard color combinations are available.

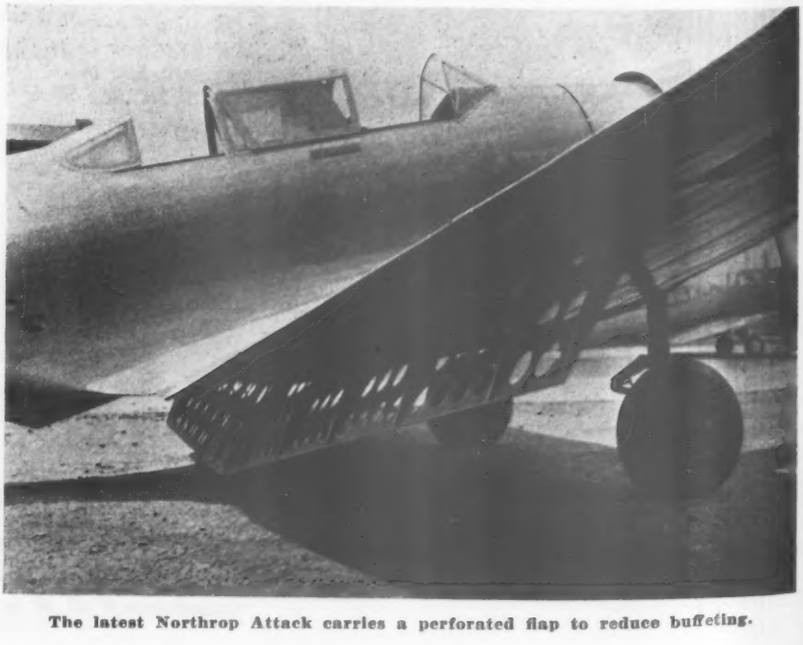
The new Fairchild weighs 1,465 lb. empty and 2,400 lb. gross. High speed is 134 m.p.h., cruising speed (8,000 ft.) is 124 m.p.h.; (sea level) 114 m.p.h. Range is 500 miles.

Arrow Model F

Most conventional of D. of C. projects has converted Ford V-8 engine

MOST of the Air Commerce Bureau's development projects embody radical features in airplane design, but the Arrow Model F airplane is surprisingly conventional in both design and construction. It is a wood and steel tube fabric covered low wing monoplane with strut braced wings and side-by-side seating for two passengers in an open cockpit, selling for $1,500. If there is anything unusual about it, it is the power plant,—a Ford V-8 engine which is so very slightly converted that almost all the parts can be purchased from local Ford dealers.

The conversion of the engine consists simply of the removal of two pumps, replacement of generator and oil pan by lighter units, slight increase in tolerances of pistons, and substitution of reduction gearing for the fly wheel. After this has been done the result is a 1.95:1 geared, water cooled engine developing



The latest Northrop Attack carries a perforated flap to reduce buffeting.

82 hp. at 3,075 r.p.m., and weighing (dry with starter) 398 lb. Overall height is 33 in., overall length 41.5 in. and overall width, 20.5 in. Other specifications are: bore, 3 1/16 in., stroke, 3 1/4 in.; displacement, 221 cu.in.; compression ratio, 6.3:1; fuel consumption at rated speed, 0.51 lb. per hp.-hr.; and oil consumption, 0.005 lb. per hp.-hr.

The cylinder block is a one-piece, cast iron standard Ford part. Full skirt aluminum alloy pistons are used and carry two compression and two oil rings. Single direct cam and spring operated valves of chrome nickel steel are used. Crankshafts and connecting rod assembly are also standard Ford V-8 parts.

Starter and water pump are specially made by the Arrow company while the diaphragm type aluminum fuel pump is an A.C. product. The dual down draft carburetor is made by Stromberg and the generator by Electric Autolite. Champion spark plugs are standard.

The airplane is equipped with manually operated split trailing edge flaps and has a fixed landing gear available with tail wheel or skid. Goodrich tires, Hayes wheels and Bendix brakes are standard equipment.

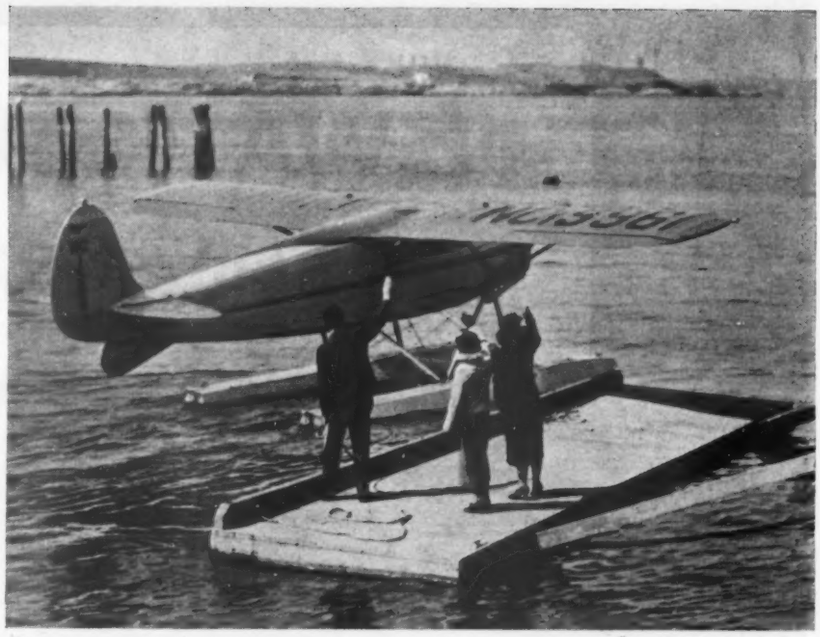
General specifications are: span, 36 ft.; length, 21 ft.; height, 9 ft.; weight empty, 1,118 lb.; useful load, 557 lb.; gross weight, 1,675 lb.; wing area, 180 sq.ft. Performance—maximum speed, 95 m.p.h.; cruising speed, 86 m.p.h. (2,900 r.p.m.); landing speed, (flaps up), 48 m.p.h.; (flaps down), 45 m.p.h.; and service ceiling, 12,000 ft. Fuel capacity is 20 gal. and cruising range, 350 miles.

The Arrow Aircraft & Motors Corporation (Lincoln, Neb.) is now building its distribution organization and is planning to sell on a time payment plan developed by Dr. Harold W. Trott. Terms: $800 down; $700 in twelve monthly installments.

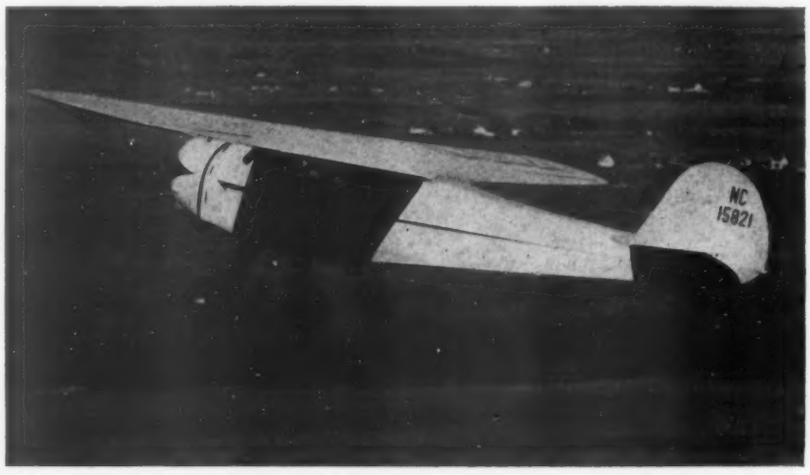
Perforated Flaps

Northrop Attack carries new type flap to eliminate buffeting

READERS will remember that one of the possible solutions offered by Prof. Manfred Rauscher for tail buffeting was in diffusing or breaking up the irregularities of the wake of a wing. As a means of accomplishing this he suggested cutting fore-and-aft slits in trailing edge flaps. (Flutter, Fig. 15, p. 29, AVIATION, February, 1936.) First full-scale application of this principle that has come to our attention is on the latest Northrop attack delivered to the Air Corps at Wright Field for test. Instead of the slits, however, the diffusing action is attained by punching relatively large holes (they appear to be 5 or 6 in. in diameter) over the entire flap area. Although no test data are available, a preliminary report indicates that the cutaway areas are about as effective as flaps as the solid type.



A.T.C. was awarded to this Fairchild Ranger 24 on Edo floats following tests at College Point by Dick Henson, Fairchild test pilot, and approval by Department of Commerce Inspector George Gay. Performance is comparable to that of the "Warner 24." After the flights, the ship was delivered to H. B. duPont of Wilmington, who will operate it from Frank Mills' Essington Seaplane Base.

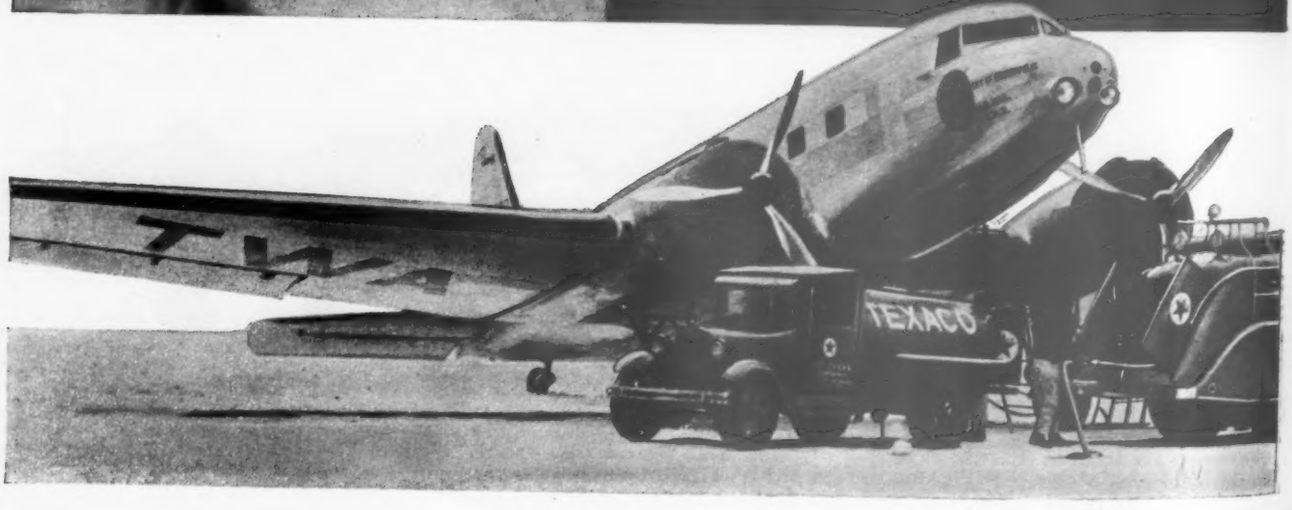


Cessna C-34 in flight over Wichita. This 4-place machine is powered with a Warner Super Scarab (145 hp.), has a top speed at sea level of 162 m.p.h. It was described in detail in AVIATION, November, 1935.

First commercial product of Ben O. Howard and Gordon Israel is this high wing monoplane evolved from "Mister Mulligan," the famous racer. Complete details will be published in an early issue of AVIATION.

NEWARK TO FLIGHT 1

variable . . . thickening haze



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. . . we took all these into consideration when we made these oils . . .

. . . we went to the makers of your engines and found out from them what conditions were to be met . . .

. . . we went up into the air and proved them in practical tests . . .

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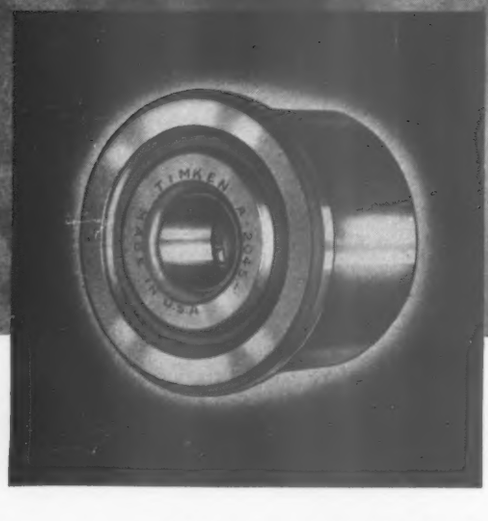


ROCKER ARM PROTECTION BY TIMKEN

Airplane engine rocker arms mounted on Timken Bearings function with maximum efficiency because friction is eliminated and rocker arms are held in correct and constant alignment under all operating conditions. Timken-equipped rocker arms are just as dependable as they are efficient, for wear is reduced to the vanishing point; radial-thrust loads are carried with a wide margin of safety; and proper lubrication is assured. Years of experience in radial engines in scheduled air line service have proved that Timken Rocker Arm Bearings need less attention and cost less for maintenance than any other types of bearings used in airplane engine rocker arms. You need this modern refinement in your aircraft engines. It will pay you to see that you get it.

Tapered Roller TIMKEN BEARING EQUIPPED

A symbol of quality for any piece of equipment with which it is associated

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN TAPERED ROLLER BEARINGS

Operator's Corner

An exchange of ideas on the problems of the commercial aviation industry

QUESTION 14: What do you think of the present regulations for medical examinations for flight students? Do they discourage students from getting started because of the expenditure of time or money involved. Would there be any great risk in amending them to defer the examination until the student had several hours of dual? Should the number of medical examiners be increased or should the examination privilege be extended to other physicans? Should the Air Commerce Bureau permit operators to charge for the flight demonstration time up to one hour that is now allowed only if given free?

Half present prices sufficient

EVERYONE admits that a physical exam of some sort is indispensable from an angle of safety alone in flying. It is no advertisement for aviation if students crack up planes throughout the country, purely because of physical handicaps which should have kept them out of ships to begin with. However, there is a very real fault in the system of physical examinations as it now exists.

There is no reason why an examination cannot be given at half the price or lower than it is at present, with complete thoroughness, and still have the doctor receive a decent fee for his work. The average student's allowance (we operate in a university town) is $10 a week, from which $3 or $4 can easily be spent for flying time. But to have a $10 fee staring one in the face, before even beginning, is more than enough to scare off the majority of potential students.

We believe that with enough agitation among operators for such a situation, an original health exam would be given for not more than $5, and $3 for renewals. —D. E. RICHARDSON, *Manager, Ann Arbor Air Service, Ann Arbor, Mich.*

Encourages illegal flying

IT is unquestionably true that the present medical regulations discourage students and limit the development of the private plane industry.

Years ago students prepared to spend $300 for ten hours of dual instruction would balk at a $10 medical fee and subsequently lose interest. This was true during the boom year of 1929. It is doubly true today when $10 constitutes from 10 to 25 per cent of the cost of a primary dual course.

In aviation we are accustomed to thinking of flight surgeons and examinations. Getting out of that rut the whole picture looks wrong.

The young man in the country is forced to travel from 60 to 100 miles to take a medical exam before he is allowed to take dual instruction. He pays a fee which is too small where living costs and overhead are high, and too large in small towns where the overhead is low. In addition the difficulty and cost of securing student permits for a simple art builds up the super-man legend with the public. Yet we want the public to fly.

At present, we have hundreds of fans who are occasionally getting a few minutes at the controls with friends; a half hour here and a demonstration flight there; perhaps a couple of hours cross-country in a cabin ship; and in some cases an illegal solo flight. Soon we will have thousands in this U.S. who "illegally" possess flying skill. And they won't be convinced they are risking their lives in handling the controls without a student permit.

It would seem sensible to extend the examination privilege to physicians on a large scale. Lower the cost. Require student licenses only for solo flying. Make it easy to fly non-commercially. Eventually this will be done. Why not now?—ARTHUR SEGER PEIRCE, *Educational Director, Taylor Aircraft Company, Bradford, Pa.*

Use family physicians

THE present medical examination requirements discourage students. There would be no risk in amending rules to enable several hours of dual instruction to be given without a medical examination by competent transport instructors.

My recommendation would be that the Department of Commerce print a regular form which could be ordered by instructors and kept available for any student Then let the student take this medical questionnaire to any doctor he selects or to his family physician. If the student is normal let the family doctor pass him and give a permit. But in case there is any question of doubt, then the family doctor would have to refer the student to the nearest federal medical examiner, as at present.

In any case, up to one hour of paid demonstration-instruction time should be allowed as any competent instructor certainly has enough common sense to detect a person who was mentally deficient. The present regulations just tend to strangle aviation.—L. G. MASON, *Montgomery School Aeronautics.*

Question 16

(Answers will be published in July)

WHAT is your method of estimating fares for taxi service? Do you base the charge on a straight mileage basis or on other factors? Do you charge an extra premium for night flying or flying under unusual conditions? Have you found your charges agreeable to customers?

★

QUESTION 15: Do you give free instruction to plane purchasers? If so, do you give them any further instruction beyond solo? Do you charge for demonstration time given in selling airplanes? In the sale of planes for executive or business service, do you give the prospect an opportunity to use the ship on trial?

Free time offered

WE offer to give free instruction to anyone purchasing a new airplane, but in only one case have we been requested to do this. In this case we took the student only to his first solo, after which we made him a nominal charge of $2.50 per hour of instruction.

We have never offered the use of a plane to a prospect for use on a trial and do not believe that such a trial would be necessary. In the case of a pilot of reasonable ability, however, we would not hesitate to turn the ship over to him for a three or four-day trial.—WINSTON W. KRATZ, *President, St. Louis Flying Service, St. Louis, Mo.*

Give free instruction

WE always give free instructions to plane purchasers up to solo and any further instruction they may need if they have difficulties. Demonstrations are given free unless the time runs into an unusual amount. We will give the prospective purchaser a chance to use the airplane on trial if we consider them as a bonafide prospect.—J. L. MEADOWS, *President, Portland Air Service, Inc., Portland, Ore.*

No free instruction

I DO not give free instruction to plane purchasers. The fee is $3 per hour. I do not charge for demonstrations, but will not lend or furnish even executives a ship on trial.—PAUL G. ODNEAL, *President, Copperclad Airways, Phoenix, Ariz.*

CHANCE VOUGHT AIRCRAFT
East Hartford, Connecticut
DIVISION OF UNITED AIRCRAFT
MANUFACTURING CORPORATION

Eighty-four of these SBU-1 Scout-Bombers have gone into service with the U. S. Fleet during the past few months. Outstanding in performance and tactical effectiveness, they are already adding new lustre to this famous name—

Vought Corsair

Buyers' Log Book

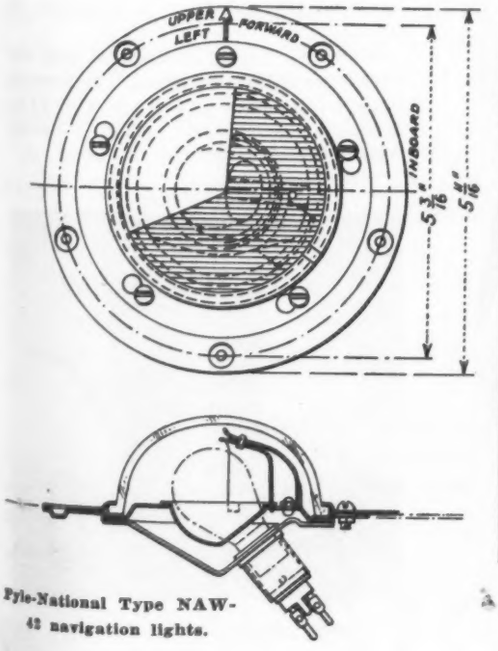
What's New in Accessories, Materials, Supplies, and Equipment

Navigation Lights

Pyle-National receives A.T.C. on new Navigation lights

NAVIGATION LIGHTS designed especially for transport planes by the Pyle-National Company of Chicago, have recently been awarded A.T.C. No. 28 by U.S. Department of Commerce. Although fitted with a 15-candle-power lamp, from three to five times greater forward intensity of illumination is obtained than is required by the Department specifications. Each set consists of an upper and lower light for the right wing tip and the same for the left wing. Mounting frames are of aluminum. Cover glasses are of Pyrex glass and are stained to a true aeronautical red and green color. The socket is a Douglas solid current path type. The socket is adapted for 15, 21, or 32-candlepower lamps. A clever focusing device is built into each socket so that proper focus is attained for any size of lamp used without complicated adjustment.

Replacement of lamps is a matter of removing the outer cover glass. The frame is clearly marked so that it cannot be installed incorrectly, and when the cover glass is removed and replaced, it has a registering position to prevent it from being incorrectly located. Each light section assembly weighs about 8 oz.



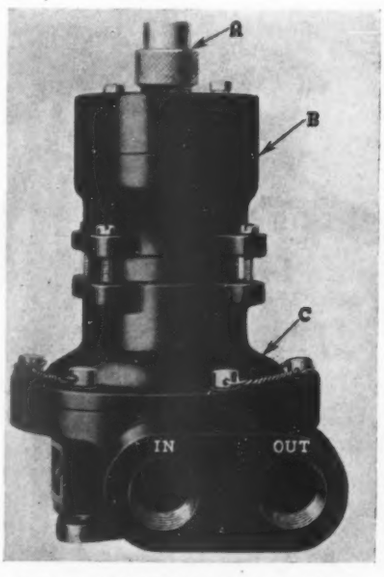
Pyle-National Type NAW-42 navigation lights.

Eclipse Items

Synchroscope and remote reading flow meter announced

AMONG several new products of the Eclipse Aviation Corp. exhibited at the recent Los Angeles Show, were a new synchroscope and a remote reading fuel meter. The former is designed to permit synchronization of engines on multi-engine airplanes. The installation does not require any additional equipment on engines nor any additional wiring connections between the cockpit and the engines. The synchroscope is mounted on the instrument board and is cut into the ignition circuits by a light gage wire to each of the engine magneto switches. Only one instrument is required regardless of the number of engines to be synchronized. The installation is very light, weighing approximately 10 oz.

The flowmeter has been developed as a means of measuring the instantaneous rate of flow of liquids, and is particularly adaptable for measuring fuel consumption in aircraft engines. It consists of two units, the metering unit which is installed between the fuel pump and the carburetor, and the indicator, mounted on the instrument board. Connecting them is a standard Pioneer Auto-Syn. The transmitting motor is mounted on the metering unit and the receiving motor on the indicator. Range of the meter is from 5 to 100 gal. per hour, with accuracy within plus or minus 1 per cent over the entire range. The entire transmitter unit weighs 3 lb. 13 oz., the indicator 15 oz.



Remote reading flowmeter by Eclipse. A, Wiring connection; B, Autosyn transmitting motor; C, meter.

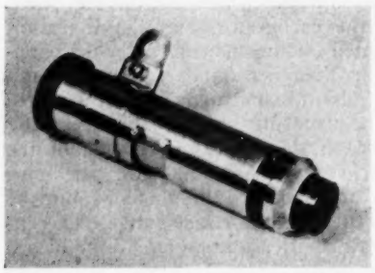
Moon Glow

Fairchild offers new type instrument illuminator and map light

DESIGNED to furnish improved illumination for aircraft instrument boards is a new illuminator announced by Fairchild Aerial Camera Corp. of Woodside, L. I., N. Y. When mounted at an angle

The Eclipse Synchroscope.

above the pilot's head, the light is thrown on and reflected away from the instrument board downward and not in the pilot's eyes. Window reflections are also eliminated. The device is 3¼ in. long and ⅞ in. in diameter. Its current consumption is ¼ amp. at 12 volts. The metal shell is fitted with a knurled ring at the forward end for diaphragm adjustment. A removable light bulb socket is fitted into the rear end of the shell. A window fitted with a sliding shutter in the side of the shell may be opened for reading maps or for general cabin illumination. The diaphragm is so designed that the light may be concentrated on a few instruments or on a special group, or it may be fanned out. Mounted 2 ft. from the instrument panel, the circle of illumination is 16 in., at 3 ft. it is 24 in.



Fairchild instrument board illuminator

Face of Pioneer Type 941 compass.

Pioneer Compass

Type 941 Compass designed to meet aircraft specifications

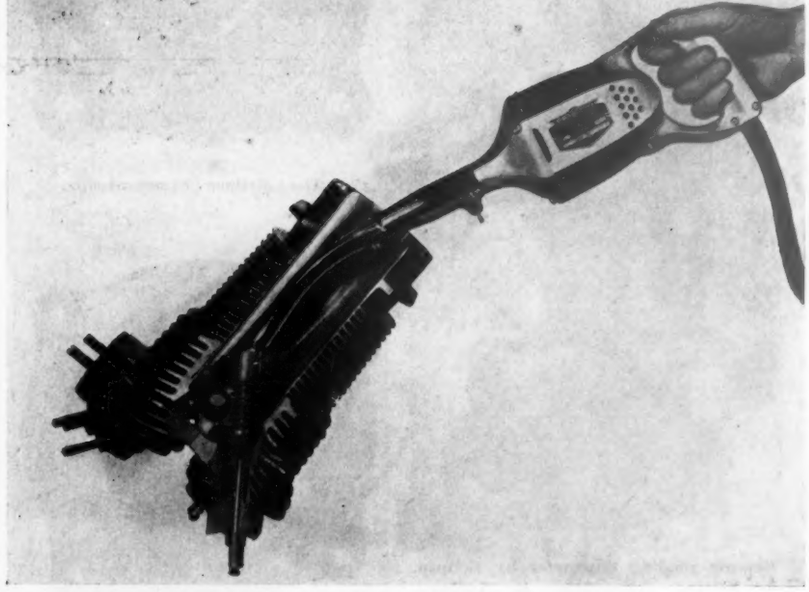
TO MEET an Army requirement for small light-weight instruments, capable of withstanding violent maneuvers, the Pioneer Instrument Co. (754 Lexington Ave., Brooklyn, N. Y.) is offering the Type 941 compass. The card is of the float type, spring suspended. The lens is cylindrical. A metal diaphragm in the liquid chamber provides for expansion and contraction of the liquid and prevents formation of bubbles. Illumination is secured by small lamps whose light is projected onto the lubber line and on the front of the card. Lamps are of the 12 volt type, are easily replaceable in flight. Two spares are carried in convenient locations. Compensation is built in. The case is interchangeable with other A-N standard instruments.

Valve Seat Grinder

Black & Decker develops new tool for aircraft engine use

A VALVE grinding tool developed particularly for aircraft engine use is offered by Black & Decker (Towson, Md.). The Vibro-Centric driving unit has a spindle speed of 12,000 r.p.m. with a positive vibration action. This action lifts the grinding stone from the valve seat at each revolution and throws off particles that might load the stone quickly and require frequent dressing. The angle drive attachment shown in the photograph fits the nose of the driver and reaches the inaccessible seats of aircraft cylinders, keeping the driver outside the cylinder. This prevents possibility of scoring or damage to the cylinder wall. Self-centering pilots are provided to provide a rigid axis for the seat-grinding stone.

An aircraft kit is available containing complete valve seat reconditioning equipment for any make of aircraft engines. All sizes of stone are available to suit any specifications.



B&D Vibro-Centric valve grinder.

Hypressure Jenny

A new low-priced, high pressure vapor spray cleaning unit

A NUMBER of airline maintenance shops make use of high pressure spray cleaning equipment manufactured by Homestead Valve Manufacturing Co. (Coraopolis, Pa.) known as Hypressure Jenny. This company is now marketing a new unit, the Model G, smaller and less expensive but operating on the same principle. Combinations of water vapor, hot water and cleaning chemicals may be sprayed from suitable nozzles at pressures ranging from 50 to 150 lb. per sq.in. The unit is fully self-contained carrying water, solution and oil tanks, oil burners, vapor generators, water and solution pumps, electric motor and a specially constructed vapor hose with a variety of nozzles. Temperature and pressure are automatically controlled. Safety valves are provided. A saturation selector enables the operator to change his spray for wetter or dryer vapor as required. No boiler inspection, or licensed operator is required to handle.

Model G. Jenny is made in both stationary and portable types. The portable model is mounted on a truck with 10 in. diameter semi-steel roller bearing wheels, 2½ in. wide.

The portable Model G Jenny.

3 HOURS *Faster*

CHICAGO *to* NEW ORLEANS

via WHIRLWIND *Powered* LOCKHEED ELECTRA TRANSPORTS

Wright Whirlwind 450 h.p. Engines power the fleet of new, all-metal, twin-engine Lockheed Electra Transports placed in service May 1, 1936, on Chicago and Southern Air Lines.

Cruising at 180 m.p.h., the swift, Whirlwind-powered Electras have clipped three hours' flying time from Chicago to New Orleans—and cut time proportionately to all intermediate points along "The Valley Level Route."

Chicago and Southern Air Lines is the third air transport operator to install fleets of Wright Whirlwind-powered Lockheed Electras during the past year. High-speed transports of this type are also in operation on Eastern Air Lines and Delta Air Lines.

The new 450 h.p. Whirlwinds are twice as powerful as the Whirlwind which powered Colonel Lindbergh's famous flight from New York to Paris in May, 1927. Since that memorable flight, Wright Whirlwinds and Cyclones have provided dependable, economical power for hundreds of millions of miles of passenger and air mail transportation.

Wright Cyclone and Whirlwind Engines are now standard power equipment on leading airlines of the United States and throughout the world.

CHICAGO & SOUTHERN AIR LINES

NEW SCHEDULES

South Bound

Lv. Chicago	Ar. New Orleans
9:15 A.M.	4:35 P. M.
5:30 P. M.	12:15 A.M.

North Bound

Lv. New Orleans	Ar. Chicago
9:05 A.M.	3:40 P. M.
5:00 P. M.	11:59 P. M.

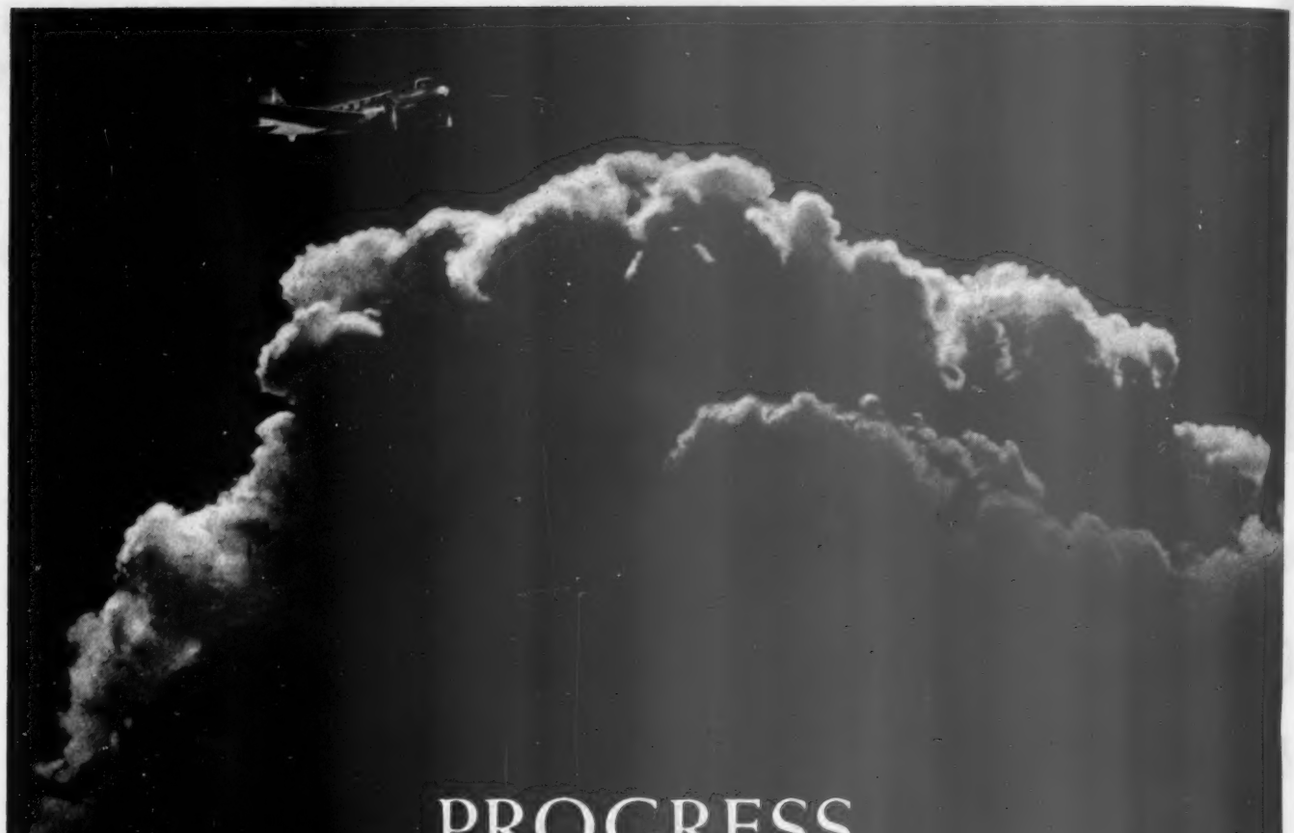
WRIGHT

AERONAUTICAL CORPORATION
PATERSON NEW JERSEY

A DIVISION OF CURTISS-WRIGHT CORPORATION

CHICAGO & SOUTHERN AIR LINES

CHICAGO
PEORIA
BLOOMINGTON
SPRINGFIELD
ST. LOUIS
MEMPHIS
GREENWOOD
JACKSON
NEW ORLEANS



PROGRESS

This month marks the tenth anniversary of the beginning of scheduled airline transportation in the United States. Six years previously, Pioneer had started the development of many of the instruments which have since been a part of the equipment of every plane flown on the airlines.

Pioneer has always kept ahead of the needs of air transportation, developing new instruments and improving existing types to meet the requirements of increased performance of aircraft and the demand for safe operation under adverse conditions.

An important factor in Pioneer's leadership is the experience gained in sixteen years of research and manufacture.

PIONEER INSTRUMENTS

PIONEER INSTRUMENT COMPANY, INC. • 754 LEXINGTON AVENUE • BROOKLYN, N. Y.
A SUBSIDIARY OF THE BENDIX AVIATION CORPORATION

News of the Month

★ ***World Transport*** . . . **Pan American to build radio stations for transatlantic service . . . Col. John H. Jouett named contact man between Navy and zeppelin operators by Standard of N. J. . . . Sikorsky proposes big boat . . . Accident at Trinidad.**

★ ***Domestic Transport*** . . . **American Airlines moves operations offices to Chicago, with Hugh Smith directing; reestablishes through Cincinnati-New York schedule . . . Traffic records for Central and Pennsylvania . . . National Parks sets up own servicing shop at Butte . . . More mail pay for Northwest . . . New schedules for Braniff . . . Non-stop 4¼ hour New York-Chicago service on TWA; accident at Uniontown . . . United inaugurates air tours, completes soundproofing . . . Ten years without accident for Western Air Express.**

★ ***Army*** . . . **Bids on four single-place pursuits, rejected last January because they failed to meet specifications, opened at Wright Field.**

★ ***Outstanding Flights*** . . . **Hughes breaks Miami-New York record . . . Four international altitude marks for Sikorsky S-43, which will next make a bid for speed-with-load marks.**

★ ***Development*** . . . **Hammond Y ready for tests . . . Guggenheim School of Aeronautics at New York University gets 150 ft. experimental towing tank.**

★ ***Foreign*** . . . **Successful year for Canada.**

★ ***Industrial*** . . . **Order for Vultee . . . Consolidated and Boeing to expand . . . Financial success for West Coast show . . . Activity at Taylor . . . New subsidiaries for Eaton Manufacturing, Fairchild Aviation.**

★ ***Financial*** . . . **Profits for Aero Supply, National Aviation, Ex-Cell-O Aircraft.**

Transatlantic

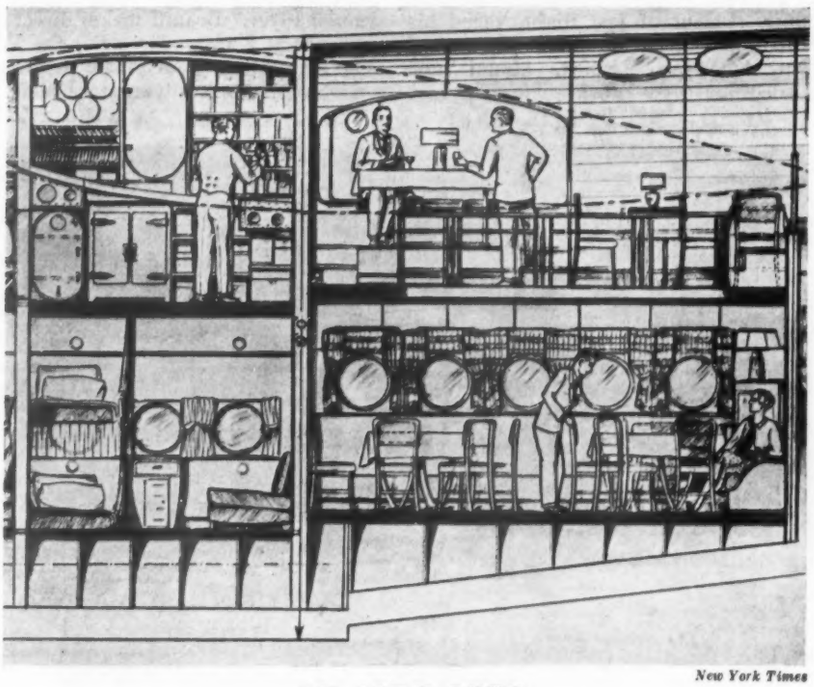
PAA to erect radio stations; Sikorsky ready to build 55 ton flying boat; Standard to fuel Hindenburg

LATEST MOVE in the transatlantic chess game gives Pan American Airways the right to construct two radio stations on Long Island, New York. Permission was granted by the Federal Communications Commission for one station at Port Washington Seaplane Base, which PAA owns and another "somewhere between Southampton and Amagansett." The Port Washington station will have a range of about 800 miles, the eastern station 1,800 miles.

Diesel oil and hydrogen gas for the Hindenburg, due to arrive at Lakehurst, N. J., on the first of ten trips to the United States early this month, will be supplied by Standard Oil of New Jersey. A million and a half cubic feet of hydrogen and 15,000 gal. of diesel fuel will be required on each visit. The hydrogen will be transported in special cars loaned by the Navy, which is cooperating with the Deutsche Zeppelin Reederei in providing landing facilities at the Naval Air Station. Standard Oil has assigned Col. John H. Jouett, of its aviation department, as one of its contacts between the zeppelin operators and the Navy. Colonel Jouett was formerly with the lighter-than-air branch of the Army Air Corps.

Rumors current in the industry concerning a super-seaplane by Sikorsky have recently been confirmed. On drawing boards and layout floors at the Bridgeport plant, ready for mock-up, is a 55 ton flying boat designed to sleep 48 passengers.

The ship will vary somewhat in outward appearance from usual Sikorsky practice. Wing span will be about 180 ft., hull beam about 15 ft. Where the



New York Times

AN AIRY STEP

will be possible on the dance floor (which is shown at right) of this newest Sikorsky creation in flying boats. It measures about 15x15 ft. Above it, reached by a curved stairway, is a cocktail lounge balcony, with seats recessed into the wing for vision straight down. To the left is the galley and a typical stateroom.

S-42 and the S-43 wings were almost parasolled in treatment, the wing on the new ship will be set below the top of the hull. The pilots' compartment, in the extreme nose, will be flush with the fuselage.

The interior arrangement offers spaciousness and comfort. Passengers will be carried on two decks, with eight cabins for four on the lower deck, eight for two above. The dining saloon will also be a dance floor. Forward of this, in the plane of the propellers, will be the engineer's station and galley. Back of the pilots' compartment will be the captain's cabin. Sleeping provisions for a crew of five will permit carrying a full relief crew.

She will cruise 4,500 miles on the power from six 1,000 hp. radial engines —probably the latest in Pratt & Whitney Twin Wasps (see page 33). Engines will be faired into the leading edge of the wing, which is so large that they will be accessible from within. So clean aerodynamically is the design that Mr. Sikorsky expects the boat to cruise at 170 m.p.h. with fuel consumption of only .45 lb. per brake hp. hr.—about a mile a gallon. She will carry 11,000-12,000 lb. payload.

Third Record

Hughes Guns his Northrop Gamma from Miami to New York in record time

AT ELEVEN minutes before noon April 21 Howard Hughes, oil-man, movie producer, student of fast flight, raced his Northrop Gamma down the runway of Pan American Airport, Miami, and headed for New York. He had said before starting that he hoped to make the trip in five hours. To Jacksonville he averaged 252 m.p.h., in spite of a climb to 13,750 ft. His Wright G Cyclone, he said, was "turning up to 1,000 hp. at the take-off and showed 800 all through the climb."

Near Raleigh, N. C., his radio quit. The rest of the way was almost wholly blind, with occasional glimpses of towns he couldn't identify. He finally roared across Floyd Bennett Field, N. Y., four hours, 21 minutes, 32 seconds out of Miami, to break the old record, set by the late Jimmy Wedell, by 40 minutes, seven seconds. Hughes' average time was 276 m.p.h. He holds two other records: Landplane speed, 352 m.p.h.; transcontinental speed, nine hours, 27 minutes, ten seconds.

Transport Looks Up

New operations set-up for American; Braniff's "Centennial Flyer"; traffic records for Central and Pennsylvania; N.P.A. overhauls at Butte; more mail pay for Northwest

SOUTHERN and Eastern Division operations offices of American Airlines have been consolidated in Chicago, under the direction of Hugh Smith, who has been named operations manager of the whole system. Smith was formerly general superintendent of the Southern Division, with headquarters in Fort Worth.

To overcome objections of Cincinnati-New York through passengers who had to make a transfer connection at Washington, American has reestablished its through schedule, using Douglas DC-2s. The run will leave Cincinnati at 2:15 p.m. and New York at 2:30 p.m., both schedules stopping at Washington. Eastbound flights will take three hours 42 minutes, West-bound four hours thirteen minutes.

With the inauguration of the "Centennial Flyer," Braniff makes direct connections at Kansas City with the West. The new schedules originate in Chicago and San Antonio, flying to Dallas and Kansas City, respectively. Equipment will be Lockheed "Electras."

Two lines operating through the area worst stricken in Pennsylvania's recent floods set up phenomenal traffic records in March: Central Airlines, with a 212 per cent passenger increase over February, and Pennsylvania Airlines, with passenger totals up 80 per cent (488 per cent on the Detroit-Milwaukee Division). Increases in express shipments, due largely to shipment of emergency supplies into the flood area, were 142 per cent for Central, 581 per cent for Pennsylvania.

Expenditure of $17,000 gives National Parks Airways facilities at Butte, Mont., to do all their own engine and plane overhaul work. Frank Tobin, superintendent of maintenance for the line, is in charge of the shops. Overhauling was previously done at the United Air Lines shops in Cheyenne, Wyo.

The Interstate Commerce Commission has fixed higher mail pay rates for Northwest Airlines on Routes AM 16 (Chicago-Fargo-Pembina) and AM3 (Fargo-Seattle). The line was receiving 25 cents a mile on Route 3 and 22 cents a mile on Route 6 when it petitioned for an increase June 27, 1935. Retroactive from the time the new rates go into effect to that date, an additional 7 cents a mile will be paid on Route 3, and an additional 8 cents on Route 16. New rates: Route AM 16, from 28 cents for 110,000 miles or over to 33 cents for 80,000 miles or less; Route AM 3, from 31 cents for 145,000 miles or over to 33 cents for 137,500 miles or less.

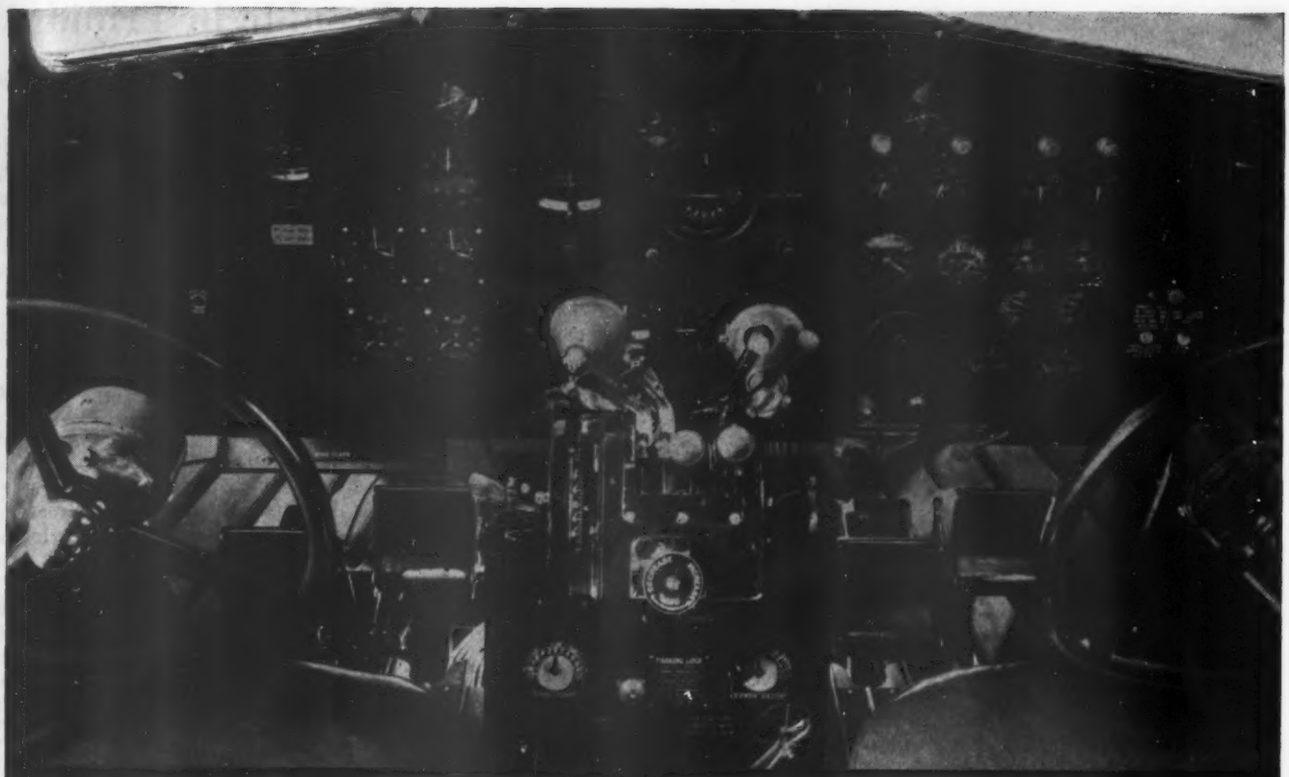
Because their duplication of service between Chicago and Kansas City is costly and wasteful, TWA and Braniff are considering consolidation of operation or schedule changes. So far, the plan is still in the negotiation stage.

May 1 TWA inaugurated a 4¾ hour non-stop schedule between New York and Chicago, leaving New York at 4:30 p.m., and Chicago at 1:10 p.m.

To persuade the annual army of vacation travellers that the best way to see America is from the air, United Air

TO TEST Y'S

and wherefores of light planes for private use, the Bureau of Air Commerce has ordered fifteen of these 125 hp. Menasco-powered Hammond Y pushers. (See also page 31.) John Geisse (left), head of the development section of the Bureau, flew this one to Washington April 14. Eugene Vidal, Director of Air Commerce, was among the first to try it out at Hoover Airport.



EVERY INSTRUMENT IS ANOTHER REASON FOR

AIRWHEELS*

AS FLYING becomes more instrumentalized—as pilots place more and more reliance upon meters, gauges and other devices—the more important it becomes to keep these instruments ever-accurate.

The best protection any ship can have is Goodyear Airwheels.

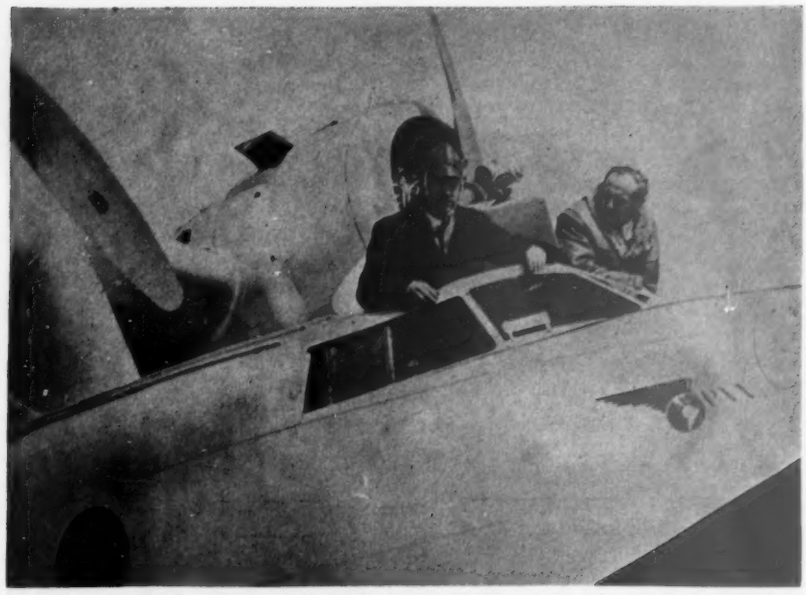
These big, buoyant, featherbed-soft tires cushion delicate mechanisms from damaging shocks and jolts, both in landing and taking off, that can easily jam an indicator-hand or snap a tiny electrical connection—*the little things that sometimes lead to accidents.*

Add the protection they afford the whole ship from ground stresses and vibrations—their proved ability to land safely and smoothly on fields impossible with other tires—and it is easy to see why Airwheels are the safest tire equipment.

Isn't that the best of reasons why you should switch to Airwheels—just as more and more passenger transport lines are doing every year? For complete engineering data, write Goodyear, Akron, Ohio, or Los Angeles, California.

*If it isn't a Goodyear, it isn't an Airwheel. AIRWHEEL *is Goodyear's trade-mark, registered in the U.S.A. and throughout the world, and is used to denote that Goodyear is the exclusive maker of* AIRWHEEL *tires*

ON YOUR NEW SHIP SPECIFY GOODYEAR AIRWHEELS AND GOODYEAR HYDRAULIC AIRPLANE BRAKES



RECORDS FELL

when this Sikorsky S-43 climbed to 27,950 ft. at Stratford, Conn. She was in command of Chief Sikorsky Test Pilot Boris Sergievsky, with Designer Igor Sikorsky as official observer.

Lines has issued a booklet of vacation tours of the national parks, Alaska, the Pacific Coast and Hawaii, giving itinerary, description of the points of interest, and costs.

Early in April, UAL completed soundproofing its fleet of 50 twin-engined Boeing 247-D's. Work was done in the main overhaul shops at Cheyenne, Wyo., under the direction of the C. F. Burgess Laboratories. A 1 in. lining of balsam wool was applied to the walls and floors, windows were reset to reduce vibration, balsam wool sheets were attached to doors and bulk-heads, and then the cabins were lined with oilcloth.

The safety and fire prevention committee of the Salt Lake City, Utah, Chamber of Commerce on April 17 presented Western Air Express President Alvin P. Adams a bronze plaque in recognition of the company's ten years of service without injury to a single passenger. WAE began regular operations between Salt Lake City and Los Angeles April 17, 1926 (see page 22).

Tops for Ducks

S-43 sets four altitude records at Mollison Airport

APRIL 14, with Igor Sikorsky aboard as official observer, a Sikorsky S-43 amphibian lifted sharply from the Mollison Airport, Stratford, Conn. An hour and a half later it landed on the nearby Housatonic River, with undoubtable evidence that it had set new international altitude marks for amphibians without payload and for amphibians carrying 1,102 lb. (500 kilograms). Altimeter reading at top of climb: 27,950 ft.

To Chief Sikorsky Test Pilot Boris Sergievsky championships are no novelty. He already held some ten national, seven international seaplane and amphibian records. Eleven days later the same ship and crew established two more international marks: altitude with 1,000 and 2,000 kilogram loads (2,205 and 4,410 lb.). Indicated altitude: 20,000 ft.

Previous best marks in the two categories concerned were 18,642 ft. without payload, 17,877 ft. with the 500 kilogram burden. The former was held by Harry Richman, the latter by Lieut. R. L. Burke of the Coast Guard.

Assaults on other amphibian records were planned for the S-43 in succeeding weeks. It is powered with two Pratt and Whitney S1EG geared Hornets delivering 750 hp. each at 7,000 ft.

Calendar

May 15-June 1—International Aero Exhibition, Stockholm, Sweden.
May 21—Dinner of Royal Aeronautical Society, 24th Wilbur Wright Memorial Lecture, London.
June 12-13-14—Missouri State Air Tour, St. Louis, Mo.
June 19-20—Second National Intercollegiate Flying Club Meet, Wayne County Airport, Detroit.
June 20-July 5—Seventh Annual National Soaring Contest, Elmira, N. Y.
June 22-28—Eighth Annual Indiana Air Tour, Indianapolis, Ind.
July 3-4-5—National Balloon Race and Air Race Meet, Denver, Col.
Sept. 3-6—National Air Races.
Oct. 25—Paris-Saigon Air Race.

Trouble in Trinidad

Puerto Rican Clipper Sinks in Harbor

JUST before dawn April 11 Capt. Wallace Culbertson of Pan American's Sikorsky S-42 Puerto Rican Clipper taxied his ship out from the float of the seaplane base in Port of Spain, Trinidad. Ahead of him across the harbor stretched a row of lights marking the seaplane take-off lane.

Captain Culbertson pushed forward the throttles. The big boat gathered speed. Suddenly when it had reached a speed of about 50 m.p.h. the lights of the standby launch were seen almost dead ahead. The pilot threw the wheel hard over, throwing his right wing-tip float deep under water, putting the ship into a sharp ground-loop, tearing a gap in the side of the front hull compartment.

Of the eighteen passengers and seven crew members, all but three escaped safely to be picked up by the launch. These three were the first fatalities in over seven years of Pan American's South American seaplane operations.

Orders, Expansion

Vultee gets bomber order; Boeing, Consolidated to expand; new subsidiaries for Eaton Mfg., Fairchild; Taylor sells 50

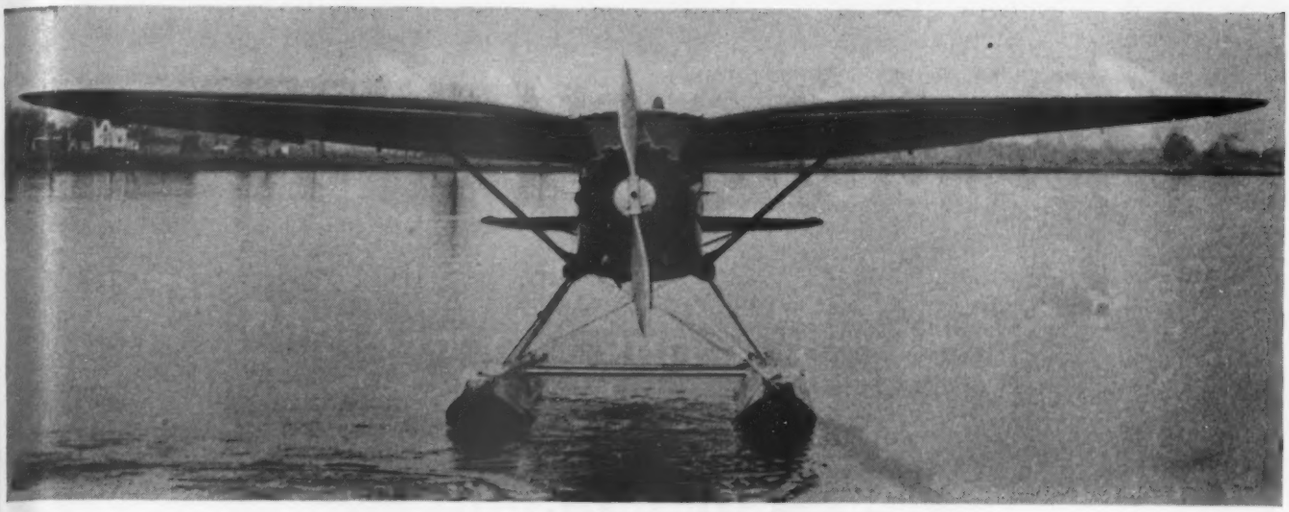
INDUSTRIAL developments of the month seemed to center largely on the Pacific Coast:

To Vultee (Airplane Development Corp., Los Angeles) went an order from an unnamed foreign government for 31 bombers. They will be similar to the V-11 Cyclone-powered Military model described in AVIATION, January, 1936.

The Boeing Aircraft Company has announced plans for expansion at its Seattle plant. Coincident with the observance of its twentieth anniversary, the company has purchased an additional 28 acres adjacent to Boeing Field. A new assembly building will be completed there before the end of the year. At present the company occupies 336,472 sq.ft. of floor space.

Consolidated Aircraft, in production on an order for 60 patrol boats for the Navy, will practically double existing space at its San Diego plant with the addition of 200,000 sq.ft. at a cost of $800,000. Included in the plans is a 52,000 sq.ft. experimental building. A stockholders' meeting was scheduled for April to authorize issuance of 60,000 shares of preferred stock to pay for capital expenditures already made and for future expansion.

The National Pacific Aircraft and Boat Show, held in Los Angeles early in February, last month reported financ-



Stinson Reliant (Model 1936 SR7-B) On Pontoons

"Gets Off Like a Scared Teal"

SPEED
Cruises over 120 MPH

TAKEOFF
Under 30 Seconds with full load on 'glassy' water.

CLIMB
Initial Climb More Than 650 FPM.

LANDING
Lands short after steep glide over obstructions by using Slotted Vacuum Flaps.

USEFUL LOAD
1200 Pounds

The 1936 Stinson "Reliant" Model SR7-B takes on the characteristics of a water bird when equipped with Pontoons.

A noted Authority states — "That plane acts more like a land plane than any pontoon job I ever tested. The way it FLIES OFF glassy water with 5% overload is extraordinary."

For the Sportsman or Commercial Operator this Stinson is truly the "Float Job" of the year with its wings HIGH out of the spray and its structure built to "Take it" under conditions where less capable craft are in the Hangar.

If you contemplate the purchase of an airplane equipped with Pontoons, investigate this 1936 Stinson Reliant before you buy—its superiority is outstanding.

SEND FOR MAY ISSUE — STINSON PLANE NEWS

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DIVISION AVIATION MFG. CORP.

WAYNE, MICHIGAN, U.S.A.

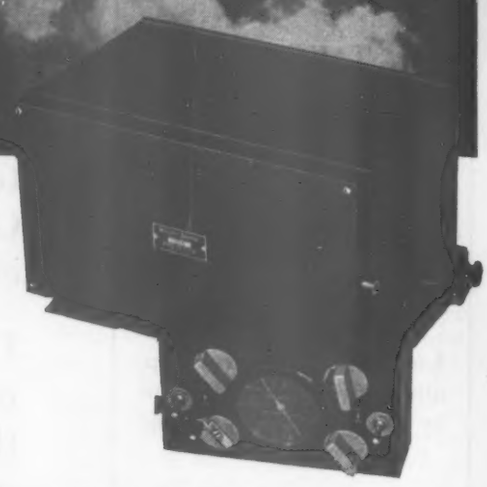
It covers all 4 bands

200 TO 400 KC - BEACONS AND WEATHER REPORTS

550 TO 1500 KC - COMMERCIAL BROADCASTS

1500 TO 4000 KC - AIRCRAFT COMMUNICATIONS

4000 TO 10,000 KC - AIRCRAFT COMMUNICATIONS



NEW 14 pound RECEIVER for commercial and private planes

Western Electric's new 20 type radio receiver is ideal for all types of flying. A light, compact, 4 tube superheterodyne, it provides unusual selectivity and the four bands cover ALL aviation services plus the broadcast band.

Outstanding features: Accurate, calibrated tuning with either remote or local control; crystal controlled oscillator if desired; improved automatic volume control; static reducer.

Built for exacting service, the 20 type receiver is as sturdy and dependable as the larger Western Electric units used by every mail carrying airline in the country.

The new bulletin gives full details of this remarkable receiver. Write to Western Electric Co., Dept. 302A, 195 Broadway, New York, for your copy.

When you fly the airlines you fly with Western Electric Radio.

Western Electric 20B Receiver and its 27A Remote Control Unit. The 20A Receiver is locally controlled.

and for 2-way

radio telephone, install the popular Midget Transmitter. Weight: 10 lbs., 10 ozs. Remote or local control. Quick shift from 3105 to 3120KC. Operates from 12 volt plane battery.

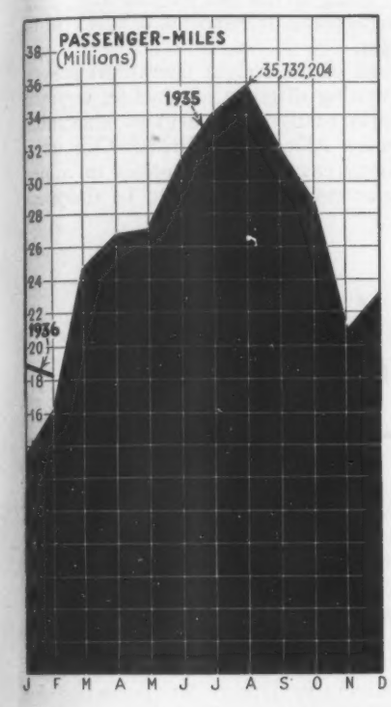
Western Electric

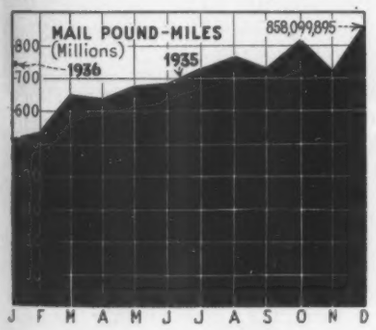
Northern Electric in Canada

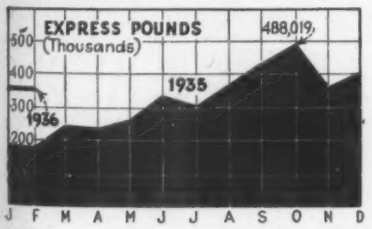
TWO-WAY AVIATION RADIO TELEPHONE AND TELEGRAPH EQUIPMENT

Traffic

Latest available statistics from the Bureau of Air Commerce and the Post Office Department—Domestic airlines only







ial success, and announced a 14 per cent refund on exhibitors' space commitments. The show was under the direction of Clifford W. Henderson.

Coming East, the Taylor Aircraft Company, of Bradford, Pa., turned out 23 New "Cubs" in the 26 working days in March—sixteen of them in the last week of the month. In April the company received an order for 50 from the Bennett Air Service of Hightstown, N. J.

British Aero Components, Ltd., has been organized at Coventry, England, as a subsidiary of the Eaton Manufacturing Co., according to an announcement by President J. O. Eaton. The new company will produce sodium cooled valves and other precision motor parts. Early production has been largely for the Bristol Aeroplane Co. and Rolls Royce.

Sherman M. Fairchild, president of Fairchild Aviation Corp., has announced the formation of a new subsidiary, Fairchild Aviation, Inc., with Ernest Robinson, since 1928 president of the Fairchild Aerial Camera Corp., at its head. The new company will handle export sales: 3- and 5-place private and commercial planes, aerial cameras, Kruesi radio compasses, Ranger engines, and transport planes. The new sales policy has been active since January.

Berry Brothers, of Detroit, has received an order for two carloads of Berryloid Aircraft Finishes from the Consolidated Aircraft Corp. of San Diego. It is for use on the Navy's twin-engined patrol boats.

Mountain Tragedy

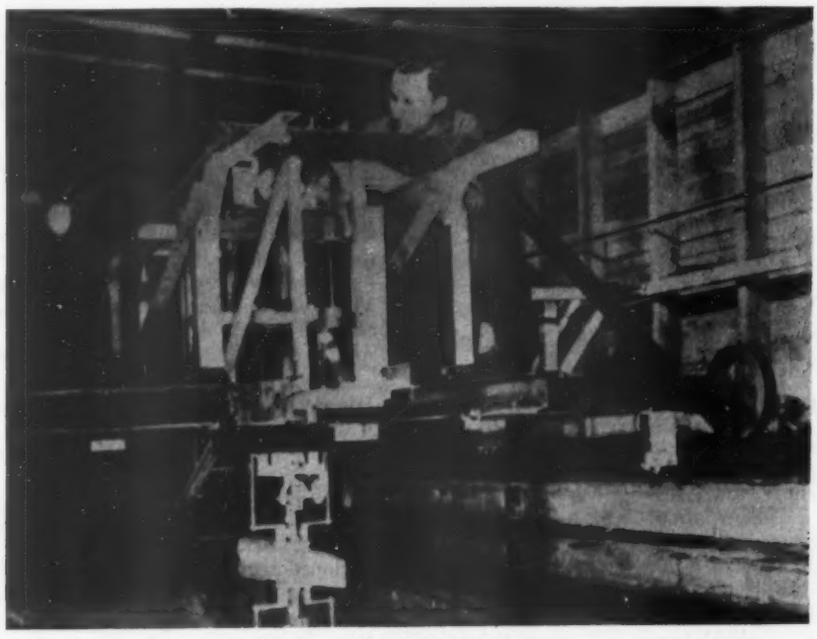
Hostess emerges as Heroine of TWA crash

At 10:09 a.m., April 7, the radio dispatcher at Pittsburgh's Allegheny County airport received a positive report from TWA's crack Sun Racer. Pilot Otto Ferguson was 10 miles east of Pittsburgh; for some time he had been flying through fog at 3,000 ft.; now he was "letting down" for his landing.

The ceiling at Pittsburgh was 1,700 ft. But nearly four hours passed before further word came from the plane and the fourteen people aboard her. Then it came by phone from a farmhouse near Uniontown, Pa., some 30 miles to the south. Nellie Granger, the plane's hostess, had gone into the pilot's compartment at 10. Ferguson had told her he would land "about 10:12." Back in the cabin Miss Granger saw to the fastening of the passengers' belts, then took her own seat. Suddenly through the fog she glimpsed tree tops "terribly close." Then they crashed into a wooded mountainside.

Some time later—she had been knocked out—she came to, hobbled about dragging the two surviving passengers clear of the wreckage before it burst into flames, then ran down the mountainside for assistance.. One of the two she had helped died a week later to bring the fatality total to ten passengers, two crew members.

Almost immediately a three-cornered investigation was started by the Air Commerce Bureau, company officials and the Senate Committee investigating airline safety. As quickly, a debate opened between TWA and Bureau officials on the condition of the Pittsburgh beam station at the time of the accident, or rather beam stations, for both the older type of transmitter and



NO SWIMMING

is permitted in the new towing tank built at New York University under the direction of Prof. Alexander Klemin, director of the Guggenheim School and Assistant Professor Frederick K. Teichmann. Funds were furnished by the Advisory Committee of the School and engineering aid came from CWA. The basin is 150 ft. long, 8 ft. wide, and 4 ft. deep. Carriage speed varies from ½ to 20 m.p.h. Constant speed run is 90 ft.

the new type which does not interrupt the course signals during weather broadcasts were in operation.

To TWA testimony that the beam had recently gone "haywire," Bureau officials pointed out that an eastbound Central Airlines plane had flown the beam satisfactorily into Pittsburgh at 9:37. Another TWA plane flying direct from Newark had landed with no trouble. A Bureau plane sent aloft immediately upon receipt of the crash news had found the beam working properly.

As a reward for her heroism, TWA promoted Nellie Granger to be hostess on the "Sky Chief," awarded her a West Indies cruise.

Bids for Pursuits

In single-seat pursuit competition Curtiss bids low, then Vought, Seversky, Consolidated

A SECOND TRY to meet Air Corps specifications for single-seat pursuits was started when bids were opened at Wright Field, Dayton, April 15 on four entrants. In January the first lot of bids was rejected because none of them "completely met the desired attainments of the modern pursuit plane."

Low bidder was Curtiss Aeroplane & Motor Corp.: $29,412 each on an order of 25, and $14,150 each for 200. Chance Vought Aircraft Division of United Aircraft Manufacturing Corp. bid $34,148 for 25, and $16,051 for 200. For 25, Seversky Aircraft Engineering Corp. bid $34,900, with a bid of $15,800 for 200. Highest was Consolidated Aircraft Corp. with a $44,000 bid on a lot of 25, and $24,260 for 200.

Awards will be made after evaluation by a procurement board considering price, performance, and ease of maintenance.

Financial

Year-end statements of Aero Supply, Aviation Corp., Fairchild. National Aviation shows $350,000 profit for first quarter of 1936

AERO Supply Manufacturing Co. reported a profit of $20,870 or $1.46 a share, for 1935.

The Aviation Corp. lost $432,422 last year, compared with a loss of $32,859 in 1934.

Fairchild Aviation Corp. showed a $98,868 loss, after depreciation, interest, federal taxes, and other deductions, compared with a $65,002 loss in 1934.

First quarter profits for National Aviation for 1936 amount to $351,296.

Another first-quarter-earner to report was Ex-Cell-O Aircraft and Tool Corp., which earned $2,221.

Canadian Transport

Air service in the Dominion carried more than three billion pound-miles of mail in 1935

FIGURES received recently from Canada show an impressive total for air operations in the Dominion during 1935. Express and freight shipments amounted to 26,439,224 lb., mail to 3,704,162,000 pound-miles. Canada's largest air-transport company, Canadian Airways, carried 13,687 passengers and 5,228,770 lb. of freight.

More than 80 per cent of express and freight operations during the year were in regions west of the Great Lakes.

About two-thirds of the express and freight was carried by ten companies, operating 100 planes, and employing 113 pilots and 107 air engineers. One operator, doing all his own piloting and using a single plane, transported 676,045 lb. of freight.

Most of the freight operations served the mining districts of Quebec, western Ontario, eastern and northern Manitoba, northern Alberta and British Columbia, in many cases taking supplies to mines so inaccessible they had to be dropped.

New Volumes

DIESEL AIRCRAFT ENGINES, *by Paul H. Wilkinson; published by Paul H. Wilkinson, 160 Jay St., Brooklyn, N. Y.; 157 pages; $3.50.*

A CONCISE and up-to-date review of the latest developments in diesel engines and their equipment for aircraft use. Describes and gives specifications for all known aviation diesel designs in this country and abroad. Well printed, copiously illustrated, adequately indexed.

•

THE AIRCRAFT YEARBOOK FOR 1936, *edited by Howard Mingos; the Aeronautical Chamber of Commerce of America, Inc., New York; 526 pages; $3.50.*

FOR the eighteenth consecutive year the record of aeronautics in America is set down in the Chamber's Yearbook. Few compilations of the facts of any industry compare in accuracy and in completeness with this annual handbook. Well written and well edited, it is a "must" for any aeronautical library.

•

ENCYCLOPEDIA OF AVIATION (Overseas Edition), *edited by C. G. Burge; Pitman Publishing Corporation, New York; 642 pages. $5.*

ALTHOUGH written entirely from the British point of view, the Encyclopedia contains much that is of interest to the general reader. The book suffers, however, by being spread too thin. It attempts to be a complete history, a glossary of terms, and a handbook of technical information covering everything from wind tunnels to meteorology. As a history of aeronautics it falls short of Bouche's magnificent job of three years ago. As a glossary it can scarcely compete with Schlomann's "Technische Wörterbücher." It is copiously illustrated, but many of the pictures lose much of their value through mediocre reproduction.

•

ELEMENTS OF DIESEL ENGINEERING, *by Orville Adams; The Norman W. Henley Publishing Company, New York; 478 pages; $4.*

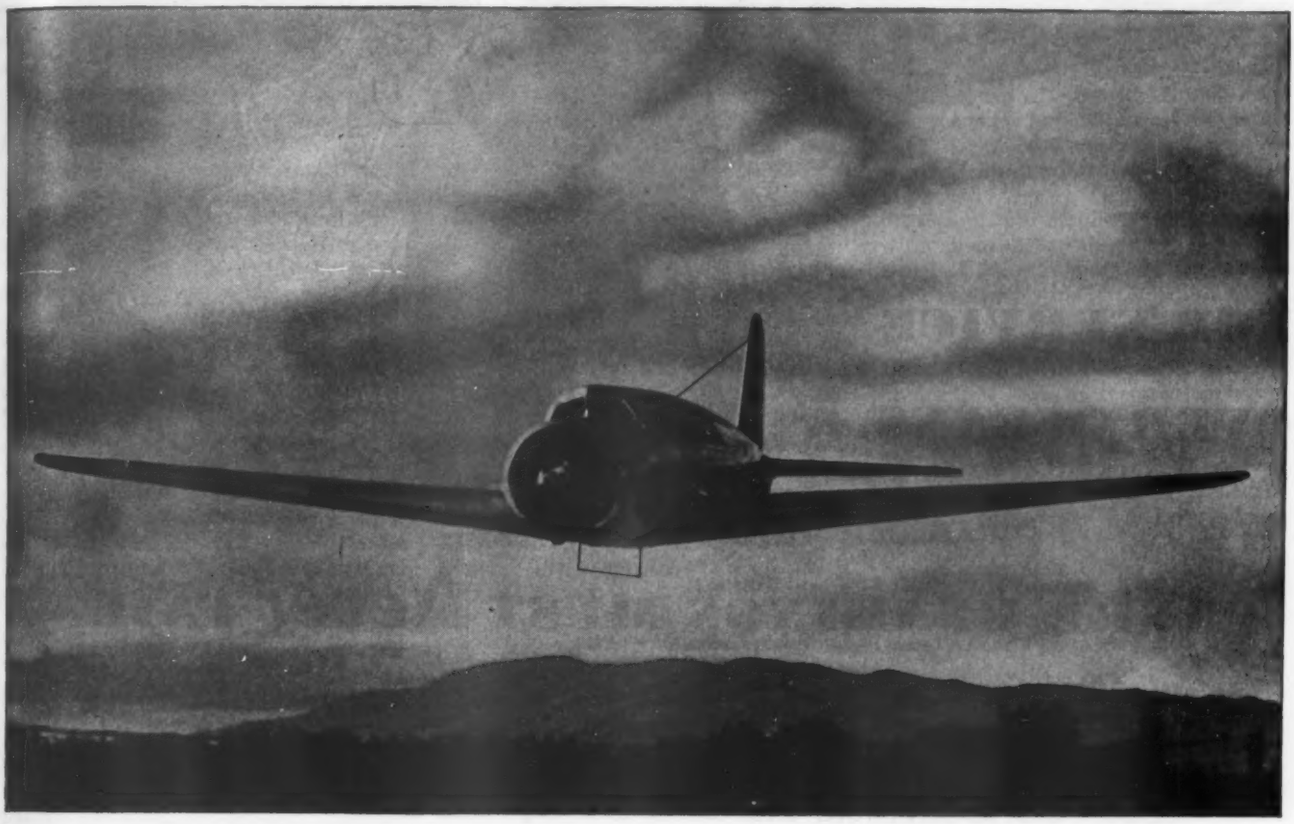
COVERING much broader territory than Mr. Wilkinson's book mentioned elsewhere on this page is Adams' treatise on diesel engineering. It is intended for general classroom and home study use on diesel problems in general and covers the whole field of engineering practice including stationary, marine, locomotive and automotive types. For student use, each chapter is supplied with a comprehensive set of questions and answers covering the topics studied.

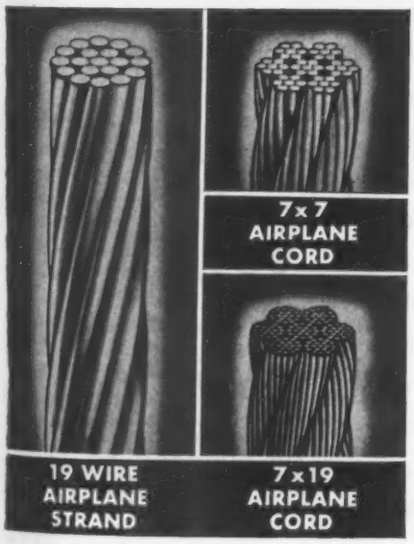
•

INTERNATIONAL ORGANIZATION IN EUROPEAN AIR TRANSPORT, *by Lawrence C. Tombs; Columbia University Press; New York; 219 pages; $3.*

THE author, as a member of the League of Nation's Secretariat, has represented the League at aviation conferences during the past five years, has had unusual opportunities to study aviation affairs in Europe. He traces the rise of air transport in Europe and the complicated international legal situations that have resulted, and concludes that international organization in European air transport is still far from complete, but is a reality. He looks upon it as the essential element in the preservation of international peace.

Everything's under Control





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There's the 19 Wire Construction — a semi-rigid galvanized cable of high tensile strength, designed to resist sudden strains and excessive vibration. The 7 x 7 *cord* is a flexible cord and is used as a control cable because of its flexibility, also because of its extremely high strength in a small diameter cable.

The 7 x 19 cord is extra flexible. It is made of six strands of nineteen wires each around a center strand of like construction. Made from a special grade of best analysis steel, it offers you maximum flexibility.

These cables can be furnished either Tinned, Galvanized or USS 18-8 Stainless Steel, meeting all requirements of the latest U. S. Army and Navy Aircraft specifications. An excellent reason for ordering from . . .

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UNITED STATES STEEL

BUILT FOR SERVICE OVER OCEANS...

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They are the most widely used of all aircraft bearings—used by almost every aircraft builder. Fafnirs eliminate friction and wear, reduce maintenance. They increase the mechanical excellence and operating permanence of engine or flight controls.

First to supply aircraft bearings to the aviation industry, Fafnir today remains the standard among aircraft builders. Factory engineers will be glad to give you the benefit of their accumulated experience. Write The Fafnir Bearing Company, Aircraft Division, New Britain, Conn.... Atlanta... Chicago... Cleveland... Dallas... Detroit... Kansas City... Los Angeles... New York... Philadelphia.

Fafnir's new aircraft booklet, "BALL BEARINGS FOR AIRCRAFT," describes the complete line in detail. Copies are yours for the asking. Write us today.

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Schools, Services, and Airports

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• COLORADO—The WPA is seeking State approval of a $147,000 project to move the Colorado National Guard from Lowry Field to the DENVER Municipal Airport.

• CONNECTICUT—The State Aviation Commission has estimated that flood damage at Brainard Field, HARTFORD, amounted to $100,000. . . . BETHANY Airport has been taken over by Bethany Air Service, composed of Charles F. Arnold, chief pilot, Francis B. Field, sales manager, and O. K. Johnson, shop manager. The company will use three planes for charter work and student instruction.

• DISTRICT OF COLUMBIA—The WASHINGTON Air Derby Association, a group of amateur pilots with headquarters at College Park Airport, COLLEGE PARK, Md., have elected Chester H. Warrington president for 1936. Other officers: J. E. Steinhauer, first vice-president; E. H. Young, second vice-president; Clarence Bruce, secretary; and Harrison Somerville, treasurer.

• GEORGIA — The ATLANTA City Council has approved the lease of a 160x180 ft. tract of land at Atlanta Municipal Airport to L. G. Mason, who plans to erect hangars there. According to the lease, all buildings must be fireproof and of a permanent nature and will revert to the city at the expiration of the lease. Rental for the twenty-year period totals $9,360. . . . A caravan of twenty Taylor "Cubs" is scheduled to leave ATLANTA early in May on a tour that will cover four Southern States. The pilots will compete for an efficiency trophy posted by the Taylor Aircraft Company. The itinerary includes SAVANNAH, ORLANDO, PENSACOLA, JACKSON, TUSCALOOSA and BIRMINGHAM.

• IDAHO—Plans for a hangar and mechanic's shop to be constructed at the University of Idaho, southern branch, POCATELLO, have been submitted to the WPA. If the plans are approved a two-story building to cost approximately $40,000 will be constructed.

• ILLINOIS — The Snyder Aircraft Company has reorganized and has taken larger quarters at CHICAGO Municipal Airport. The company, under the direction of Ray Snyder, is exclusive distributor in the Chicago area for Glidden "Glidair" aircraft finishes and also conducts an instrument testing and repair shop. . . . Paul V. Eakle, manager of DeKalb County Airport, WATERMAN, announced that plans are being drawn up for construction of a new and modern hangar to replace the one in which five planes were destroyed by fire recently. . . . LeRoy Murphy, who has operated an engine and airplane overhaul shop at Mount Hawley Airport, PEORIA, has moved his equipment to SPRINGFIELD Municipal Airport. He has complete welding and woodworking equipment. . . . With improvement in the weather, the grading work on MOLINE Municipal Airport $420,000 WPA improvement project has been resumed, with about 2,000 cu.yd. of dirt being removed daily. Before the project can be completed 419,000 cu.yd. must be moved. . . . Kenneth Ringel is now sole manager of Mount Hawley Airport, PEORIA. There are five planes hangared at the field, two of them belonging to Ringel. . . . T. G. Wells has been re-elected president of the DECATUR Airport company. . . . The AA Flying Club has been formed at Curtiss-Steinberg Airport, EAST ST. LOUIS, under the direction of R. L. Nash and J. A. Roth. Annual dues are $25. Flying rates are $7.50 an hour in the Curtiss Fledgling and $5 per hour in the Taylor "Cub," either dual or solo.

• INDIANA — The Aircraft Trades Association, INDIANAPOLIS, is sponsoring the eighth annual Indiana Air Tour June 22-28. The tour will visit approximately a score of cities with the starting and finishing point at the INDIANAPOLIS Municipal Airport. Entries have been limited this year to 60 planes. . . . The St. Joseph County Board of Commissioners has taken an option to buy the Bendix Municipal Airport, SOUTH BEND, for $193,000. If the option is taken up the field will be eligible for $400,000 of WPA funds for improvements. . . . Two experimental runways to cost approximately $112,000 will be built at Purdue University Airport, LAFAYETTE, this summer. Eleven different kinds of material will go into the runways in order to test their suitability. . . . The Columbus Flying Service, Inc., has announced that Dolph W. Lenhart will be their new student instructor. He will fly the company's new C-3 Aeronca. He has a record of 52 solo students without accident.

• IOWA—The SPENCER Airport opened late in March, when the Spencer Chamber of Commerce took over its lease from the city. The chamber will pay $500 a year rental and will set aside another $50 a year for improvements and repairs. Sid Cleveland, manager of the field, had two planes at the opening.

• KANSAS—At a meeting of the WICHITA Aviation Club early in April,

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• CALIFORNIA — Joe Plosser of Grand Central Flying School, GLENDALE, has sold a Kinner Travelair and negotiated sale of a Fairchild 24. . . . Forty licensed pilots who fly for fun have organized the Aviation Country Club of California, Inc., at Grand Central Air Terminal, GLENDALE. Officers: Ben McGlashan, president; Jerry Fairbanks, vice-president; Bert Rhine, secretary; and Wally Timm, treasurer. . . . Clayton Smith is planning a three or four-day aerial tour which will start from Fresno-Chandler Airport, FRESNO, and will take in BOULDER DAM, SALT LAKE CITY and RENO. Ten ships are expected to participate. . . . Work has been started on the $538,000 air base on Terminal Island in Los ANGELES Harbor. The airport will be named Reeves Field in honor of Admiral Joseph Mason Reeves. The WPA will spend $444,000 and the city of Los ANGELES will contribute another $93,000. . . . SAN FRANCISCO and Los ANGELES were planning army day air shows early in April. Army planes from March Field were scheduled to participate in both events.

• COLORADO—The WPA is seeking State approval of a $147,000 project to move the Colorado National Guard from Lowry Field to the DENVER Municipal Airport.

• CONNECTICUT—The State Aviation Commission has estimated that flood damage at Brainard Field, HARTFORD, amounted to $100,000. . . . BETHANY Airport has been taken over by Bethany Air Service, composed of Charles F. Arnold, chief pilot, Francis B. Field, sales manager, and O. K. Johnson, shop manager. The company will use three planes for charter work and student instruction.

• DISTRICT OF COLUMBIA—The WASHINGTON Air Derby Association, a group of amateur pilots with headquarters at College Park Airport, COLLEGE PARK, Md., have elected Chester H. Warrington president for 1936. Other officers: J. E. Steinhauer, first vice-president; E. H. Young, second vice-president; Clarence Bruce, secretary; and Harrison Somerville, treasurer.

• GEORGIA — The ATLANTA City Council has approved the lease of a 160x180 ft. tract of land at Atlanta Municipal Airport to L. G. Mason, who plans to erect hangars there. According to the lease, all buildings must be fireproof and of a permanent nature and will revert to the city at the expiration of the lease. Rental for the twenty-year period totals $9,360. . . . A caravan of twenty Taylor "Cubs" is scheduled to leave ATLANTA early in May on a tour that will cover four Southern States. The pilots will compete for an efficiency trophy posted by the Taylor Aircraft Company. The itinerary includes SAVANNAH, ORLANDO, PENSACOLA, JACKSON, TUSCALOOSA and BIRMINGHAM.

• IDAHO—Plans for a hangar and mechanic's shop to be constructed at the University of Idaho, southern branch, POCATELLO, have been submitted to the WPA. If the plans are approved a two-story building to cost approximately $40,000 will be constructed.

• ILLINOIS — The Snyder Aircraft Company has reorganized and has taken larger quarters at CHICAGO Municipal Airport. The company, under the direction of Ray Snyder, is exclusive distributor in the Chicago area for Glidden "Glidair" aircraft finishes and also conducts an instrument testing and repair shop. . . . Paul V. Eakle, manager of DeKalb County Airport, WATERMAN, announced that plans are being drawn up for construction of a new and modern hangar to replace the one in which five planes were destroyed by fire recently. . . . LeRoy Murphy, who has operated an engine and airplane overhaul shop at Mount Hawley Airport, PEORIA, has moved his equipment to SPRINGFIELD Municipal Airport. He has complete welding and woodworking equipment. . . . With improvement in the weather, the grading work on MOLINE Municipal Airport $420,000 WPA improvement project has been resumed, with about 2,000 cu.yd. of dirt being removed daily. Before the project can be completed 419,000 cu.yd. must be moved. . . . Kenneth Ringel is now sole manager of Mount Hawley Airport, PEORIA. There are five planes hangared at the field, two of them belonging to Ringel. . . . T. G. Wells has been re-elected president of the DECATUR Airport company. . . . The AA Flying Club has been formed at Curtiss-Steinberg Airport, EAST ST. LOUIS, under the direction of R. L. Nash and J. A. Roth. Annual dues are $25. Flying rates are $7.50 an hour in the Curtiss Fledgling and $5 per hour in the Taylor "Cub," either dual or solo.

• INDIANA — The Aircraft Trades Association, INDIANAPOLIS, is sponsoring the eighth annual Indiana Air Tour June 22-28. The tour will visit approximately a score of cities with the starting and finishing point at the INDIANAPOLIS Municipal Airport. Entries have been limited this year to 60 planes. . . . The St. Joseph County Board of Commissioners has taken an option to buy the Bendix Municipal Airport, SOUTH BEND, for $193,000. If the option is taken up the field will be eligible for $400,000 of WPA funds for improvements. . . . Two experimental runways to cost approximately $112,000 will be built at Purdue University Airport, LAFAYETTE, this summer. Eleven different kinds of material will go into the runways in order to test their suitability. . . . The Columbus Flying Service, Inc., has announced that Dolph W. Lenhart will be their new student instructor. He will fly the company's new C-3 Aeronca. He has a record of 52 solo students without accident.

• IOWA—The SPENCER Airport opened late in March, when the Spencer Chamber of Commerce took over its lease from the city. The chamber will pay $500 a year rental and will set aside another $50 a year for improvements and repairs. Sid Cleveland, manager of the field, had two planes at the opening.

• KANSAS—At a meeting of the WICHITA Aviation Club early in April,

members heard a talk by Alfred MacDonald, director of Parks and Airports for the city. He discussed the future of Wichita Airport, speaking principally of the improvement work.

• KENTUCKY—The LEXINGTON Board of City Commissioners has voted to lease Lexington Municipal Airport for $1 a year to the Lexington Air Taxi Service. The company will pay all operating expenses and the city will pay the annual rental on the land. . . . The Bureau of Air Commerce has recommended a more comprehensive plan of improvement at MIDDLESBORO Airport. The WPA has already allotted $20,000 for the work and the city commission is asking for another $30,000. The new plans will call for an 80x100 ft. fireproof hangar and some changes in runways, including a change in direction of the north-south runway and a 600-ft. extension for the east-west runway. Power and telephone lines will be placed underground. . . . Work was scheduled to get under way late in March to double the capacity of the administration building at Bowman Field, LOUISVILLE, as a $57,000 WPA project. . . . Bureau of Air Commerce has approved a $21,380 air marking program for Kentucky. . . . Cook Aero Service, Inc., has been formed at Bowman Field, LOUISVILLE, for student instruction and charter work. Flight training will be in an Aeronca, for which the company is state dealer. Officers: Frank S. Cook, president; J. Tyler Thomas, vice-president.

• LOUISIANA—Eight planes of the NEW ORLEANS Aviation Club, carrying eighteen members, made a trip from New Orleans to GULFPORT late in March. . . . The Bureau of Air Commerce has approved expenditure of $39,618 for construction of an airport at Camp Beauregard. . . . $15,000 has been allotted by the WPA for landscaping work at Shushan Airport, NEW ORLEANS.

• MAINE—The Town of BARING will purchase St. Croix Airport and complete the work of draining and grading started some time ago. There is room at the field for a mile-long runway, and the town will seek WPA assistance for the improvement work. . . . The BANGOR City Council has voted to spend up to $30,000 for building runways at Godfrey Field. This will make the city eligible for $67,953 from the WPA.

• MARYLAND—The PWA has announced the approval of a $1,100,000 grant for completion of the municipal airport at BALTIMORE. To this the city will add $900,000. Of the total about $1,500,000 will be spent to complete the fill and the remaining $500,000 will go for runways and buildings. Completion of the airport will provide 360 acres of landing field and a seaplane operation area ranging in length from 6,000 to 20,000 ft. A sum of $3,500,000 has already been spent in building bulkheads and filling.

• MASSACHUSETTS—The Jennings Bros. Air Service has moved to Grafton Airport, NORTH GRAFTON. Three ships—a Stinson Cabin, a Taylor "Cub" and a Great Lakes trainer—will be used for charter trips and student instruction. Walter Hancock will conduct a mechanic's school. . . . BOSTON has leased Governor's Island from the War Department for fifteen years, and the island's 72 acres will be added to East Boston Airport, allowing extension of present runways.

• MICHIGAN—The State Department of Aeronautics is sponsoring a Michigan airport conference to be held at Traverse City on May 28 and 29. . . . Airport improvement projects in 35 cities have been approved by the WPA and are now under construction or will be soon. Of the 80 airport projects either approved or waiting approval, seventeen call for construction of new landing fields, eighteen for construction of new hangars and seven for construction of hard surfaced runways and taxi strips. . . . Wayne County Airport, DETROIT, has been selected as the scene of the Second National Intercollegiate Flying and Gliding Meet, June 19-20. . . . The BENTON HARBOR Airport is planning an air show for May 10. The city commission has agreed to furnish equipment and men to put the field in shape by extending and rolling runways. . . . Barr-Stanislaw, Inc., have delivered two new Taylor "Cubs" to the DETROIT City Airport and one to Eddy McEnnan, who will use it at YPSILANTI Airport.

• MISSISSIPPI—An air show featuring the Flying Aces was scheduled for early April at HATTIESBURG Municipal Airport. The show was sponsored by the American Legion.

• MISSOURI—The WPA has approved expenditure of $178,241 for airport improvements in Missouri. The projects are as follows: ST. JOSEPH, $99,967; JOPLIN, $51,764; POPLAR BLUFF, $10,984; ST. LOUIS, $4,384; NEVADA, $9,582; COLUMBIA, $1,560. . . . . W. W. Kratz, president of ST. LOUIS Flying Service, Inc., Lambert-St. Louis Municipal Airport, reports the sale of fifteen planes in the first three months of 1936. Gross returns were approximately double the same period in 1935.

• NEBRASKA — Improvements at GRAND ISLAND Municipal Airport will include a new administration building, hangar, a 200x900 ft. service apron and an asphalt runway 150 ft. wide and 4,000 ft. long. The work is a WPA project. . . . A $580,200 WPA allotment will provide concrete runways, an administration building, additional hangars and an extension of the lighting system at NORTH PLATTE Municipal Airport. . . . To succeed Clinton J. Campbell, the State Aeronautics Commission has elected Dr. W. W. Arrasmith its chairman. The commission has recently bought a Waco monoplane which will be used for state purposes and for the regular duties of the commission. Its pilot will be Charles Doyle, secretary of the commission.

• NEVADA—RENO is seeking $498,496 from the WPA for improvements at the municipal airport. Under the plan Washoe County will spend $18,000 to acquire additional land near the present field, and United Air Lines will spend $7,000 for the same purpose.

• NEW JERSEY—The Senate has confirmed the nomination of Lt. Richard Aldworth, manager of Newark Airport, as a member of the state aviation commission. . . .The Flying Clubs of America, under the direction of George G. Deverall, has announced the start of the 1936 flying season at PINE BROOK Airport.

• NEW MEXICO—ALBUQUERQUE is planning a new municipal airport 5 miles south of the University of New Mexico. Plans call for two 6,000 ft. runways, hangars and machine shops. . . . In a spot landing contest at ALBUQUERQUE Airport, early in April, first prize went to Virgil Lane; second, William Piper; third, Paul Spencer.

• NEW YORK—DUNKIRK is considering construction of a hangar on the Department of Commerce field on Middle Road. The work would be done by the WPA. . . . The Town Council of MOUNT PLEASANT will sanction establishment of an airport at VALHALLA if local opposition to the project is withdrawn. A petition bearing several hundred signatures of VALHALLA residents has been presented to the Council urging authorization to construct the field. The State WPA is awaiting authorization by the Council for allocation of funds. . . . Of the $306,504 allocated by the WPA for improvement work at BUFFALO Airport, $221,000 is still unspent. . . . Because of the lack of qualified WPA labor in SULLIVAN County, the Board of Supervisors gives no assurance that the county airport project will be completed this year. . . . Buffalo is seeking establishment of an airline between Ottawa and Washington. . . . WPA has granted $60,000 for construction of an airport at OGDENSBURG. It will be used to start excavation and grading. Another $60,-

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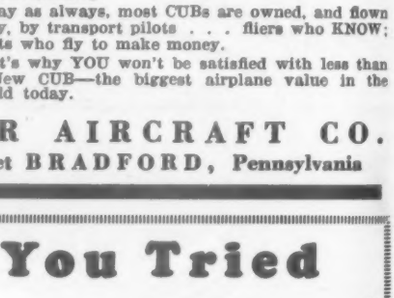

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• NORTH CAROLINA—An air show was scheduled for early April at BLACK MOUNTAIN-ASHEVILLE Airport, featuring Donnie Marshall in delayed parachute jumps. . . . WPA has approved expenditure of $68,000 for establishment of a landing field at NEW BERN. Previously $22,000 had been allocated. . . . The Bureau of Air Commerce has approved a WPA allotment of $109,000 for development of the ASHEVILLE-HENDERSONVILLE Airport. . . . Eastern Air Lines will install a radio transmitting station at CHARLOTTE Airport. A weather station has been in operation at the field for several years, but has had to rely on telegraphing information to the nearest radio transmitting station for broadcasts to planes in flight. . . . An extension to the north end of the north-south runway at Miller Municipal Airport, WINSTON-SALEM, has been completed and construction of a 3,000 ft. east-west runway is scheduled to start soon.

• OHIO—The SANDUSKY City Commission has authorized a five-year renewal of the Bureau of Air Commerce lease on Parker Field. The field is being improved by the WPA. . . . Weather delays on the WPA improvement project at CLEVELAND Airport may force abandonment of plans to hold the National Air Races at the field over Labor Day week-end. Since last fall 8,000 men have been employed on the project. With better weather conditions three steam shovels are to be used in filling the ravines at the west end of the new land being added to the field. . . . Aero-Ways, Inc., CLEVELAND Municipal Airport, has reorganized and has taken over the hangar of General Airmotive Corp. The company operates a sales service and school. Officers are: T. E. Byron, president; Eli Ellison, sales manager and treasurer and George Oberdorf, flying school instructor. . . . Members of the DAYTON Women's Aeronautical Association at a meeting late in March presented a silver trophy to Mrs. Ione Coppedge for her recent record altitude flight. . . . A $430,000 WPA improvement program at COLUMBUS Municipal Airport is expected to get under way soon. Plans include grading for the extension of the east-west runway, construction of a new runway, filling a ditch on the north side of the field, and improvement of the parking area. Plans for further improvements are being drawn. . . . Arrangements for a two-day aviation show in June at LIMA Municipal Airport have been announced. . . . General Airmotive Corp., CLEVELAND Airport, has taken the dealership for the Gulf Refining Co. at the field. President James Borton has announced that the company will open an engine repair and overhaul shop in a new hangar. . . . The YOUNGSTOWN Civic League has elected Samuel Stites its president. The League will consider possible sites for a municipal airport. The State Aeronautics Commission will cooperate in selecting a suitable site for the field after which the Youngstown City Council will act to acquire the land as much as possible by trading land it already owns for the site selected for the field. Central Air Lines has promised to make Youngstown a regular stop on its Washington-Detroit route if the city supplies an adequate airport.

• OKLAHOMA—All three airport projects in the state for which WPA funds have been released are under construction. They are: DUBUQUE, $44,269, construction of new runways; BURLINGTON, $14,890, construction of three runways, lighting, drainage, fencing and landscaping; DES MOINES, $11,414, runways and lights.

• OREGON—The following WPA improvement projects are under way: MEDFORD, $177,000 for surfacing and enlargement; NORTH BEND, $60,000 for both land and sea terminals; ASTORIA, $58,000 for seaplane facilities at existing airports and new hangar and lighting installations; PENDLETON, $44,000 for hangars, runways and paving; ROSEBURG, $35,000 for lengthening of runways and lighting; EUGENE, $14,000 for additional lighting and minor improvements; TILLAMOOK, $7,000 for grading and surfacing; ONTARIO, hard-surfacing both runways at a cost of $5,000; VERNONIA, $5,000 for enlarging landing strips and drainage. . . . Arthur Whitaker of Willamette Flying Service, PORTLAND, sold eight new Taylor "Cubs" in April. . . . The Oregon State Board of Aeronautics has drawn up a state flying code under legislative authority. It provides for a certificate of airworthiness issued by the state for all planes not federally licensed and prohibits student instruction or flying for hire in planes licensed only by the state.

• PENNSYLVANIA—First plans for a proposed city-county airport at ERIE have been approved by the State WPA and are now pending before the Bureau of Air Commerce. The original plans call for expenditure of $335,000, with a supplementary request for another $140,000 to improve the West Lake Road airfield. Erie improvements will include drainage and grading work, hard-surfaced runways and a new hangar. . . . During 1935 two airplanes left Harri Emery Airport, BRADFORD, for every one that came in. This was due to the production of Taylor "Cubs." . . . Improvement work at Merrill-Ronne Airport, MATAMORAS, will include three crushed stone oiled runways, 100x2000 ft., boundary and floodlighting and an 80x100 ft. concrete and steel hangar. Flag markers show the extent of construction work on the field. . . . The WPA will construct a $495,000 airport at CONNELLSVILLE to include an administration building, hangars, three 3,000-ft. runways, lighting system and taxi strips. . . . The LANCASTER Airport Commission has approved plans for establishment of a restaurant and dwelling on the field.

LAB FOR A LADY

The Purdue University Research Foundation has subscribed $50,000 to purchase a special Lockheed Electra for the use of Amelia Earhart Putnam, the University's consultant on careers for women, to carry on aeronautical research. Here Mrs. Putnam is talking to a class conducted by Capt. G. W. Haskins, head of the aerodynamics department

Jesse Jones has been retained as manager for another year. Also approved were the Lancaster Aero Club's plans for an air meet to be held in May. . . . The WPA has granted $100,000 for construction of an airport at WASHINGTON. Work will start as soon as the city acquires title to the land. . . . TIOGA County is considering purchase of a site for an airport if WPA funds for improvements can be secured. . . . A fund of $105,000 for two concrete runways, drainage and construction of a hangar has been granted by the WPA at Harrisburg for OIL CITY. Approximately $6,000 has been raised through public subscription for purchase of materials at the Splane Memorial Airport. . . . JOHNSTOWN has acquired a 169-acre tract for a municipal airport.

• RHODE ISLAND—NEWPORT is considering establishment of a seaplane base at Newport Airport. The Aviation Committee of the Chamber of Commerce will seek WPA funds for its construction.

• TENNESSEE—An air show was planned for late March at Lovell Field, CHATTANOOGA, featuring Donnie Marshall, a delayed parachute jumper, according to announcement by Eddie Stork, airport manager.

• TEXAS—DALLAS has been offered $43,544 by the WPA to complete the runway system at the airport, but is unable to take advantage of it because the government requires a municipal contribution of $13,733, and the city airport improvement fund is empty. . . . FORT WORTH, with the help of the WPA, will erect a new passenger terminal at the airport at a cost of $145,000, an increase of $19,000 over former estimates. The increase is due to reinstatement of specifications for marble floors and wainscoting in the rotunda and corridors, stone instead of brick for interior walls, and air conditioning equipment. The city has issued $96,000 in warrants and the WPA has granted $56,750. . . . The Texas Centennial Central Exposition, DALLAS, will conduct a junior model airplane contest on July 29. The contest has the sanction of the National Aeronautic Association . . . . WPA will spend $46,000 installing gravel and concrete runways and large hangars at LUFKIN airport.

• UTAH—The SALT LAKE CITY Commission issued bonds in the sum of $25,000 to secure $2,325,000 from the WPA for construction of an airport.

• VIRGINIA—The Bureau of Air Commerce has approved the following WPA expenditures for airport improvement: FORT EUSTIS, $10,600; BLACKSBURG, $4,757; STAUNTON, $11,681. . . . The Valley Airport, WAYNESBORO, has purchased a new Taylor "Cub" which will be used for student instruction. . . . Endless Caverns Airport, NEW MARKET, has announced an award of $200 to the feminine flier who breaks the women's altitude or distance light plane record at a meet to be held late in April or early in May.

• WASHINGTON—The Inland Empire National Defense Association will sponsor an air show at Felts Field, SPOKANE, May 29-30-31. . . . Work on a new seaplane base in SEATTLE has been halted because of the lack of WPA labor. The city has acquired for $45,000 a 38-acre site near Sand Point Naval Air Station. . . . KITSAP County Commissioners have voted $2,800 for surveying a 200-acre tract of land, 1½ miles southwest of BREMERTON for construction of an airport as an $86,000 WPA project.

• WISCONSIN — MILWAUKEE Airports, Inc., headed by Merle Zuelke, has taken over the operation of the Curtiss-Wright Airport on Highway 41. John Chapin has been appointed field manager. It is planned to conduct an airplane charter service and handle aircraft sales and service. Sixteen private flyers rent hangar space on this field.

• WYOMING—The Bureau of Air Commerce has approved a $31,000 fund for airway and airport marking throughout the State. . . . The Bureau of Air Commerce has authorized changing of the lighting system from the old municipal airport at LARAMIE to the new landing field which was constructed with WPA funds. Laramie will be required to supply power for lighting the new field, which is located several miles from the city.

Schools

• Eleven members of the Illinois National Guard Air Corps are training at the AERONAUTICAL UNIVERSITY, CHICAGO (Ill.). Since the first of the year 38 graduates have been placed in jobs. The school has an enrollment of 239 students, 96 of whom are taking the aeronautical engineering course. New additions to the school include sheet metal equipment and a new radio course.

• THE BOEING SCHOOL OF AERONAUTICS, at OAKLAND (Cal.) has announced winners of the Seventh Annual Boeing Scholarship Award, with a total value of $9,600. Winners are: first, Jack A. Gibbs, ROSEBURG (Ore.); second, E. Brewster Buxton, NIANTIC (Conn.); third, John Emery Lindberg, Jr., STOCKTON (Cal.); fourth, Heaton Owsley, BILTMORE (N. C.). The first award is the Boeing airline pilot and operations course, consisting of 250 hours of flight instruction and 3,372 hours of lectures, laboratory and shop instruction, given at the Boeing School.

• A Chinese aircraft manufacturing company has asked the CURTISS-WRIGHT TECHNICAL INSTITUTE, GLENDALE (Cal.) for Chinese students with aircraft welding and construction training. Enrollment at the Institute was reported to have passed the all-time peak in February and was nearly double the peak month in 1935. . . . The GRAND CENTRAL FLYING SCHOOL, GLENDALE (Cal.) has exchanged its early model Aeronca 70 for a new Aeronca 85.

• ROOSEVELT AVIATION SCHOOL, Roosevelt Field, MINEOLA (N. Y.) has moved from its old quarters in Unit No. 1 to Unit No. 2. A race track is being constructed on Unit No. 1.

• Within the past three months more than 50 new students have enrolled at the WARREN SCHOOL OF AERONAUTICS, Los ANGELES (Cal.). The school specializes in training of airplane mechanics. President: Charles A. Warren.

• Neil R. McCray, owner of Fairview Airport, FAIRVIEW (Pa.) is giving flying instruction to fourteen pupils. To meet the demand for instruction he has acquired two more planes, a Stinson SR7-A and a Taylor "Cub," of which he has ordered two more. . . . Eighty-nine students have enrolled for the ground school aviation course being conducted by the WPA at HAZLETON (Pa.). Instructor will be Willis Reifenberg, operator of the Hazleton Airport at ST. JOHNS. . . . Aero-Ways, Inc., CLEVELAND (Ohio) Municipal Airport, has organized a flying school. Instructor: George Oberdorf. . . . A WPA ground school under the direction of Jack Wright and Earl R. Southee was scheduled to start in BUFFALO (N. Y.) in April. The syllabus includes 690 hours of training in airplane mechanics, maintenance and construction and in navigation and air law. . . . The aviation ground school at TEANECK (N. J.) High School has an enrollment of 14 girls and 60 boys. Instructor: Arthur G. Norwood. . . . Harry Clark will act as flying instructor at a school in ELY (Nev.). Pete Ergenbright will be mechanical and ground instructor. . . . The Missouri Aviation Company, Municipal Airport, SPRINGFIELD (Mo.) has been organized for student instruction and charter service. The equipment consists of an Aeronca for primary instruction, a Travelair for advanced instruction, and a Stinson Model R and Stinson Model S for charter work. The company conducts a free ground school. Instructors will be: Leonard Trowbridge, Arch McEwen and R. C. Clayton.

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- ☐ Airline Technician (For engineering graduates only)
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*Name*_____ *Age*_____

*Years in High School*_____ *Years in College*_____

*Address*_____ *Phone*_____

*City*_____ *State*_____

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Aviation People

• When LINCOLN ELLSWORTH, first man to fly across the Antarctic Continent, raised the Stars and Stripes on James W. Ellsworth Land, deep in the heart of the Continent, on Nov. 23, 1935, he claimed for the United States the last patch of unclaimed land on earth, he told members of the National Geographic Society at Constitution Hall on April 15. Earlier in the day PRESIDENT ROOSEVELT had presented to Ellsworth the Hubbard gold medal, highest honor bestowed by the Society, in recognition of his explorations. Ellsworth's aerial expeditions date from 1925, when he flew with Amundsen over unexplored teritory near the North Pole, down to November, 1935, when he covered 2,200 miles of terrain in Antarctica, between the Weddell and Ross Seas. The Society makes particular reference to the latter in its citation. Aviation people have figured conspicuously among the twelve earlier recipients of this award. They include ADMIRAL BYRD, CAPT. AMUNDSEN, VILJALMUR STEFFANSSON, COLONEL LINDBERGH and MRS. LINDBERGH, CAPT. ALBERT W. STEVENS and CAPT. ORVIL A. ANDERSON. Additional honor was conferred on explorer Ellsworth by the Senate, which added the Distinguished Flying Cross to the special gold medal awarded him in 1928.

In New York, on April 21, the American Geographical Society expressed its appreciation of Mr. Ellsworth's exploits through presentation of the David Livingstone Centenary Medal.

• DANIEL C. SAYRE, formerly assistant editor of AVIATION, has joined the publicity department of Pan American Airways. Mr. Sayre has long been connected with the editorial activities of AVIATION, and before that was on the teaching staff of Massachusetts Institute of Technology as assistant professor of aeronautical engineering.

• TO LT. COMMANDER KNEFLER MCGINNIS come new honors in the form of the Distinguished Flying Cross, presented him on April 18 by ACTING SECRETARY OF THE NAVY WILLIAM H. STANDLEY on behalf of PRESIDENT ROOSEVELT. Commander McGinnis was in command of the Navy seaplane flight from Norfolk, Va. to San Francisco, via Coco Solo, C. Z., which established "a new international airline distance record for seaplanes of 3,281 statute miles, and a broken line distance record of 3,443 statute miles." The Navy's non-stop flight from San Francisco to Honolulu in January, 1934, also under Commander McGinnis, set up a new world's distance non-stop flight of more than 2,400 miles.

Lincoln Ellsworth

Daniel C. Sayre

Lt. Commander Knefler McGinnis

Ernest Robinson

Charles L. Lawrance

Capt. Edward V. Rickenbacker

• Fairchild Aviation Corporation announces that ERNEST ROBINSON is to be president of its newly organized subsidiary, Fairchild Aviation, Inc. (News Section). Mr. Robinson has been active in the management of the various Fairchild companies since the organization of the camera corporation in 1920, of which he became president in 1928. He has had wide experience in sales and development work in Canada, the Orient, the Near East and Europe. C. A. HARRISON, who has been sales manager of Fairchild Aerial Camera Company, has been named vice-president of the new subsidiary.

• The National Aeronautic Association has named CHARLES L. LAWRANCE chairman of the committee to select the recipient of the 1935 Collier Trophy, presented annually since 1911. Assisting Mr. Lawrence as a board of award are POWELL CROSLEY, JR., COMMANDER J. C. HUNSAKER, COL. EDGAR S. GORRELL, L. W. GREVE, FRED L. SMITH, and MAJOR ALFORD J. WILLIAMS. Mr. Lawrance, pioneer aircraft designer and himself a winner of the Collier Trophy, is also one of the administrants of the Sylvanus Albert Reed Award.

• The members of the Metropolitan Section of the S.A.E. assembled at a testimonial dinner and dance in New York City on May 1, in tribute to CAPT. EDWARD V. RICKENBACKER. The Society plans to honor one of its outstanding members each year, and began with Capt, Rickenbacker in recognition of his record as a War ace and as a leader in aeronautics. He is vice-president of North American Aviation, Inc. and since January, 1935, has been general manager of Eastern Air Lines.

• The appointment of LESTER D. SEYMOUR as vice-president and general manager of the Pitcairn Autogiro Company was announced today by Harold F. Pitcairn, president. Mr. Seymour was formerly president of American Airlines, Inc., and had been vice-president and general manager of National Air Transport Inc. during the period when that organization developed the air mail line between New York, Chicago, and Dallas, Texas. He was later vice-president of United Airlines after the consolidation of Boeing Air Transport, National Air Transport,

Pacific Air Transport and other companies.

Mr. Seymour will undertake a survey of the sales and development policies to be pursued by the Pitcairn Autogiro Company with regard to the "roadable" and direct take-off autogiros now under development by the Autogiro Company of America.

• The Harmon Trophy, the Ligue Internationale des Aviateurs' annual award as World's Outstanding Aviator, went to CAPT. EDWIN C. MUSICK for 1935. Followers of Pan American's westward saga know the part played by Captain Musick to earn him this distinction. It also won him the title of Outstanding Flyer of the United States. AMELIA EARHART's solo flight from Hawaii to California ranks her as Outstanding Woman Flyer of the United States, and makes her co-holder with JEAN BATTEN, who flew solo across the South Atlantic, of the title of World's Leading Woman Pilot. National champions for other countries were also designated.

• CAPT. JOHN H. TOWERS, former Commandant of the Naval Air Station at San Diego, Cal., has been made chief of staff to VICE-ADMIRAL HENRY V. BUTLER, Commander Aircraft, Battle Force, succeeding CAPT. AUBREY FITCH, who will command the carrier U.S.S. Lexington. His post at the Air Station will be taken over by CAPT. ARTHUR L. BRISTOL, formerly in charge of the carrier U.S.S. Ranger.

• Directors of Waco Aircraft Company, reelected at the annual meeting of stockholders, named C. J. BRUKNER president; LEE N. BRUTUS, vice-president and treasurer; and L. E. ST. JOHN, secretary.

• United Air Lines announces the appointment of F. PAT O'TOOLE to succeed G. B. LAMBERT, JR., as manager of the service department for the publishing, advertising, theatrical and entertainment fields.

• Set-up of the Bendix Aviation Corporation remained unchanged after the annual meeting of stockholders, all officers and directors having been reelected. Officers are: VINCENT BENDIX, president; WALTER J. BUETTNER, vice-president and treasurer; Messrs. KLIESRATH, MARCUS and MCGRATH, vice-presidents; W. M. HOUGHTON, comptroller; E. LEE TALMAN, assistant treasurer; HENRY A. GOSSNER, secretary; and EDWIN H. CASSELS, general counsel.

• Both Houses of Congress have passed SENATOR GLASS's bill to present silver medals to members of the second Byrd Antarctic Expedition for their "heroic and undaunted accomplishments for science, unequaled in the history of polar exploration."

Side Slips

By Robert R. Osborn

WE SEE by the papers that a group of Russian doctors has just graduated from the government parachute school and are now organizing a parachute medical service. In urgent cases the doctors will answer calls by dropping

off by parachute, when nearby landing fields are not available.

The next step, of course, is to outfit the doctor with a set of the new parachute wings, and a long beak, so that he can both look and act the part of the stork.

PLANS seem to be well under way to start Trans-Atlantic flying boat service, making four round trips per week, by way of the Azores and Bermuda. We might be persuaded to give up this South Sea Island retirement idea of ours for the job of ticket agent at Bermuda.

WE ALSO note that, with the final closing link soon to be completed between the Philippines and the K.L.M. line in Borneo, it will then be possible to travel all of the way around the world by scheduled airlines. As part of the inauguration ceremony of this around-the-world service, we suggest as the first passenger Wilbur Glenn Voliva, famous exponent of the flatness of the world.

THE PASSING of the old Roosevelt Field (Unit 1) on Long Island will inspire deep regrets from everyone in aviation, as it was richer in aeronautical history than any other place in the world. The student pilot appreciated the fact that his "spot landing" practice could be in error by a half mile without serious consequences, and the experienced pilot liked the mile-long natural runway for the take-off of his heavily loaded record-breaking airplane. Many of the most tragic, and some of the funniest, events in the annals of aviation took place on that field.

In our opinion, one of the most amazing spectacles was the public reception to Lindbergh after his flight to Paris. The bird's-eye view of the great circle of cars with the tiny speaker's platform as a center, and one third of the field solidly filled with people, was a sight to be long-remembered.

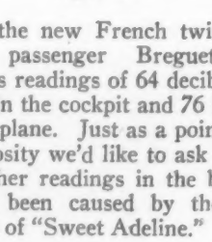
We also remember when Roosevelt Field was to be the starting point of a trans-continental race, and a few days ahead of time a mid-Western pilot brought his ship into Curtiss Field, on his first trip to the east. As he was entered in the race we asked him why he hadn't landed at Roosevelt Field. He said he had made a couple of passes at Roosevelt Field but as the field looked rather small and there were a lot of people in the grandstands he had decided to come to Curtiss instead. We wonder what would have happened if he *had* landed at the nearby Meadowbrook Polo Field where the International Polo matches were about to start.

IN the interests of greater accuracy in hangar-flying stories of the future we call attention to a recent court case between two razor blade manufacturers, now before the Supreme Court. In the petition of one of the manufacturers is the information that the well-known "hair's breadth" is exactly four thousandths of an inch.

ABOUT the middle of March we noticed an article which stated that the new Martin flying boat designed for the Pan American Trans-Pacific service was the best sound-proofed airplane in the United States, having a cabin decibel reading of only 69. A week later we read that a group of 50 senators were to be taken for flights at Baltimore in this same Martin seaplane.

We presume that this was in the nature of a very severe test for the science of sound-proofing, and that if successful results were obtained, an attempt might be made to sound-proof not only the Senate, but possibly even the House.

DR. ZAND, the expert on methods of sound-proofing airplanes, is quoted as saying that the quietest airplane in the



world is the new French twin-engined eighteen passenger Breguet-Wibault. He reports readings of 64 decibels in the cabin, 72 in the cockpit and 76 in the bar of that airplane. Just as a point of technical curiosity we'd like to ask Dr. Zand if the higher readings in the bar might not have been caused by the French equivalent of "Sweet Adeline."